INDEX TO ADVERTISERS AND CONTENTS PAGE 44.

THE FOUNDRY

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Trade Outlook.

If the iron founder expects to realize fair profits on this year's business it is plain that he must advance the price at which he is selling castings. This is of course easier said than done, yet there is no reason why the founders should operate their shops simply to accommodate consumers of castings. If present conditions continue it would appear as if further advances may be demanded by labor interests when present agreements expire, and altogether costs of manufacture are very uncertain. Every variety of fuel has reached almost prohibitive prices and manufacturing establishments find it difficult to keep running regularly. Naturally the passing of the winter months is expected to relieve this stringency to some extent. Foreign irons are being liberally imported and practically control prices at Atlantic coast points. Touching upon this, Rogers, Brown & Co. say in a recent review of the iron market:

"The discrepancy between the prices of domestic and imported irons along the Eastern seaboard is a matter of no little discussion among furnace men. There is little dissent to the proposition that home prices should be dropped at the earliest possible moment to a point that will shut out foreign irons. Two difficulties, however, stand in the way. First, the home furnaces have very little iron which they can sell between now and July, and, for that little they feel entitled to the ruling price to help the average against low-priced contracts still running. A more weighty reason is the heavy advance in cost of production experienced by the merchant furnaces. This grows largely out of the remarkable fuel situation. Commencing with the new year the monthly coke bills of most of the furnaces will be almost exactly double those of corresponding months a year ago, and this for the same tonnage. Labor is up from 15 to 30 per cent; transportation of raw materials and finished products is also generally higher. We have actually come to the point where the foreigners can pay $4.00 per ton duty and lay No. 3 Middlesbrough pig iron in Philadelphia lower than the American furnaces can meet, without loss. It is needless to say that this is a situation which gives conservative manufacturers some concern.

Unintelligent Buying and Selling.

Under the above heading the Acme Steel & Malleable Iron Works, of Buffalo, N. Y., are mailing the following circular to their customers:

"The old-fashioned way of buying and selling a line of castings by the average or flat price (one price for all shapes without specifications), is manifestly unfair, both to buyer and seller.

"Some such castings are sold at the same price as others that are worth 50 per cent to 100 per cent more or less. If the buyer pays, by purchasing at a flat price, more for a casting than he should, if classed by itself, he is misled in his estimate of cost, and certainly is not in position to compete with "up-to-date" buyers who buy their castings at independent prices.

"In these days of close competition, no manufacturer can afford to do business blindly, he must know at all times the precise cost of every article, in order to be able to sell at a profit.

"In buying castings for a specialty which contains a variety of different shaped castings, it will undoubtedly be perfectly proper to buy all of the castings for this specialty at a flat price; but, in cases where the manufacturer is purchasing a miscellaneous line of castings, it is certainly for his interest to know the exact cost of each casting in order not only to determine the selling price for the different designs, but also to determine the proper cost of the article for which the castings are used. He will often find it to his advantage to buy at independent prices; as by this system bids can be secured from different foundries on the special patterns at any time he is in the market for castings.

"Frequently it will be found that certain foundries who make a specialty of light work, will quote from 10 per cent to 50 per cent less for light castings than foundries who make a specialty of heavy work; and, on the other hand, the producers of light castings are usually found to be from 10 per cent to 50 per cent higher in price on heavy castings than those who make a specialty of this class of work. Therefore, in dividing the work as suggested, the buyer will not only know the exact cost of each casting, but will undoubtedly be able to secure a lower general average price than by any other plan."

Profit Sharing.

The four thousand employes of the Crane Co., Chicago, received 5 per cent of their yearly wages as a Christmas gift, amounting in all to about $135,000. This sum is an outright gift. Richard T. Crane, the founder and president of the corporation, has always been noted for his liberal recognition of faithful service on the part of his workmen and also for his many practical charities.

The McKenna Bros. Brass Co., of Pittsburg, Pa., have divided with about 100 of their employes 10 per cent of the past year's profits. Journeymen employes, who have been on the payroll during last year, received $45 to $70 each. The aggregate amount that the company gave to its skilled craftsmen amounted to upward of $6,000. This liberal division of profits was determined on by action of the board of managers of the company a year ago, and will be continued during the business life of the company. The profit-sharing ranges according to the wages drawn by the men during the year.

The Scientific Blacksmith Explains.

Sometime ago the following item was making the rounds of the daily press:

"James H. Duffy, the scientific blacksmith of Machias, Me., continues to make surprising discoveries in his little shop at Hadley's Lake. Not satisfied with welding copper and tempering lead, he has now discovered a process by which, as he claims, brass can be made from cheaper metals. The alloy that he uses contains about 75 or 80 per cent of lead, and after passing through the Duffy process it not only has the appearance of brass, but it can be used for all the purposes to which that metal is usually put. He declares that by this process brass can be manufactured at about 20 per cent of the ordinary cost of that metal."

A representative of the Metal Market, realizing the great importance of this discovery and the serious results it would have for manufacturers of metals, requested Mr. Duffy to give them for publication some details of his discovery. They received the following reply:

Jentlemen I temper any Kiends of metals I make Brass out of lead and silver out of lead and I am now gone to try the lost art on Glass your Respectfully

J. H. DUFFY, Machias, Me.

Acid Proof Castings.

The German metallurgical engineer, Carl Rott, writing in the "Eisenzeitung," on a subject which has troubled many foundrymen, says that in the evolution of foundry mixtures intended to produce iron which would be acid proof, as well as castings which could resist the application of heat to the greatest degree possible, the controlling idea has been the elimination of the ingredients which tend to reduce the resisting power of the materials to heat or chemical action, as the case might be. Thus for acid proof castings it is essential to have irons as low in sulphur and phosphorus as

possible; then also the carbon should be in the combined form to as great an extent as may be safely allowed. Mineral and vegetable acids affect irons readily which have high sulphur and graphite contents. Silicon and manganese do not seem to be affected as much. Here is the composition of good irons of this kind: Silicon, 0.8 to 2.00; phosphorus, 0.4-0.6; sulphur, .02-.03; manganese, 1.0-2.0, and total carbon, 3.0-3.5 per cent. Makers of pumps for mining purposes or where there is acidulated water coming from factories would do well to make a note of this. It is important to have clean coke. air furnace iron would be best, as it is freer from oxidation. Where the castings are not to be machined the fracture may be mottled to nearly white; where machining is done the grain should be as close and fine as possible. To help a little in the latter case an annealing of 24 hours can be used with advantage. As to refractory castings. Mr. Rott thinks this is not so difficult a problem. A low sulphur contents is essential; phosphorus may be normal and manganese low. It is well to have low silicon and carbon. Scrap steel is therefore a good admixture. Here is a typical analysis: Silicon, 1.8; phosphorus, 0.7; sulphur, .03; manganese, 0.6, and total carbon 2.9 per cent.—[*Journal* of the American Foundrymen's Association.]

Molder by Profession.

George W. Gladstone, the former captain of police in South Norwalk, has taken a position in the foundry of the Colonial Foundry & Machinery Co. in Kaiser place. Mr. Gladstone is a molder by profession.—Norwalk (Conn.) *Hour*.

A Definition of Piece-Work.

This is the name that has been given to the method by which a man gets paid for what he does, so if you go into a foundry during noon hour and see the molders on top of the flasks, with a rammer in one hand and a sandwich in the other, you can gamble that they are working by the piece. The best way for the foreman to set a price on a new job, is to let some young, husky apprentice go into training for a month, then tell him if he can make a certain number a day, and be sure to make the limit high enough, he will be counted as an A1 molder and will be given a good floor. If the apprentice does his duty you ought to get the castings made for a dollar an acre. Get all your jobs priced like this and if you are not making enough money you ought to sell out and go into the coal business in Brooklyn. P. J. POTTER.

There Have Been Some Resignations at Salem.

Frank Laughbaugh has been appointed foreman of the Woodruff stove foundry on Depot street. He will take charge of the work tomorrow. Stephen Wisner, who has been employed as foreman for the past year, has resigned, taking effect this evening.

It will be remembered that Mr. Laughbaugh was formerly foreman of the foundry and resigned a little over a year ago to go farming in Pennsylvania. He met with considerable success in that line, but when Mr. Wisner resigned he was again offered his old position and decided to accept. It is probable that Mr. Wisner will continue in the employ of the company as a molder.—Salem (O.) *Herald*.

They Experiment in the West.

An explosion occurred at the Downie-Wright foundry yesterday. The employes had just finished casting, and when they dumped the molten cinders and iron beneath the cupola, the accumulated moisture at once caused an explosion which shook houses blocks away. Beyond some shattered window lights and a few bricks loosened from the walls of the building no damage was done. The escape of two persons standing nearby was considered remarkable. One iron door of the cupola lodged on the roof of the building, and hot iron flew between thirty and forty feet high.—Lincoln (Nebr.) *Star*.

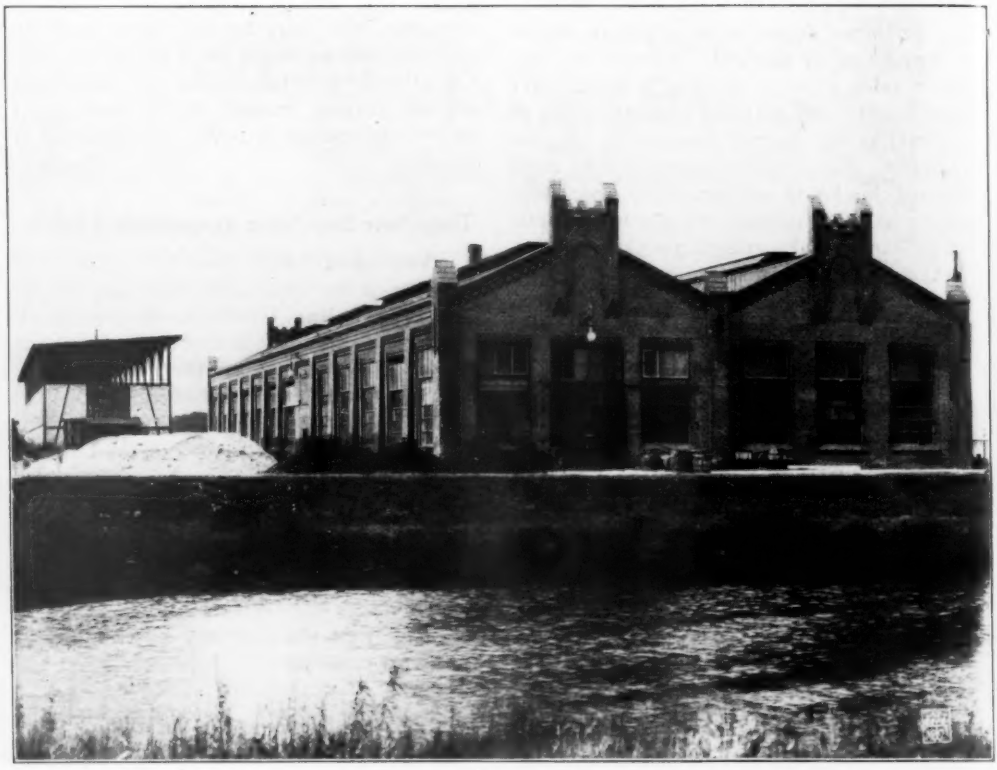
Plans are being prepared for alterations to be made at the foundry of Horace W. Middleton, 945 Ridge Ave., Philadelphia, Pa.

The Concord Foundry Co., Concord, N. C., is enlarging its foundry.

The Riverside Foundry & Machine Works, Riverside, Cal., burned Dec. 6.

The Illinois Malleable Iron Co., Chicago, will build an addition to its foundry.

The Union Iron & Foundry Co., of St. Louis, Mo., has increased its capital stock from $50,000 to $150,000.

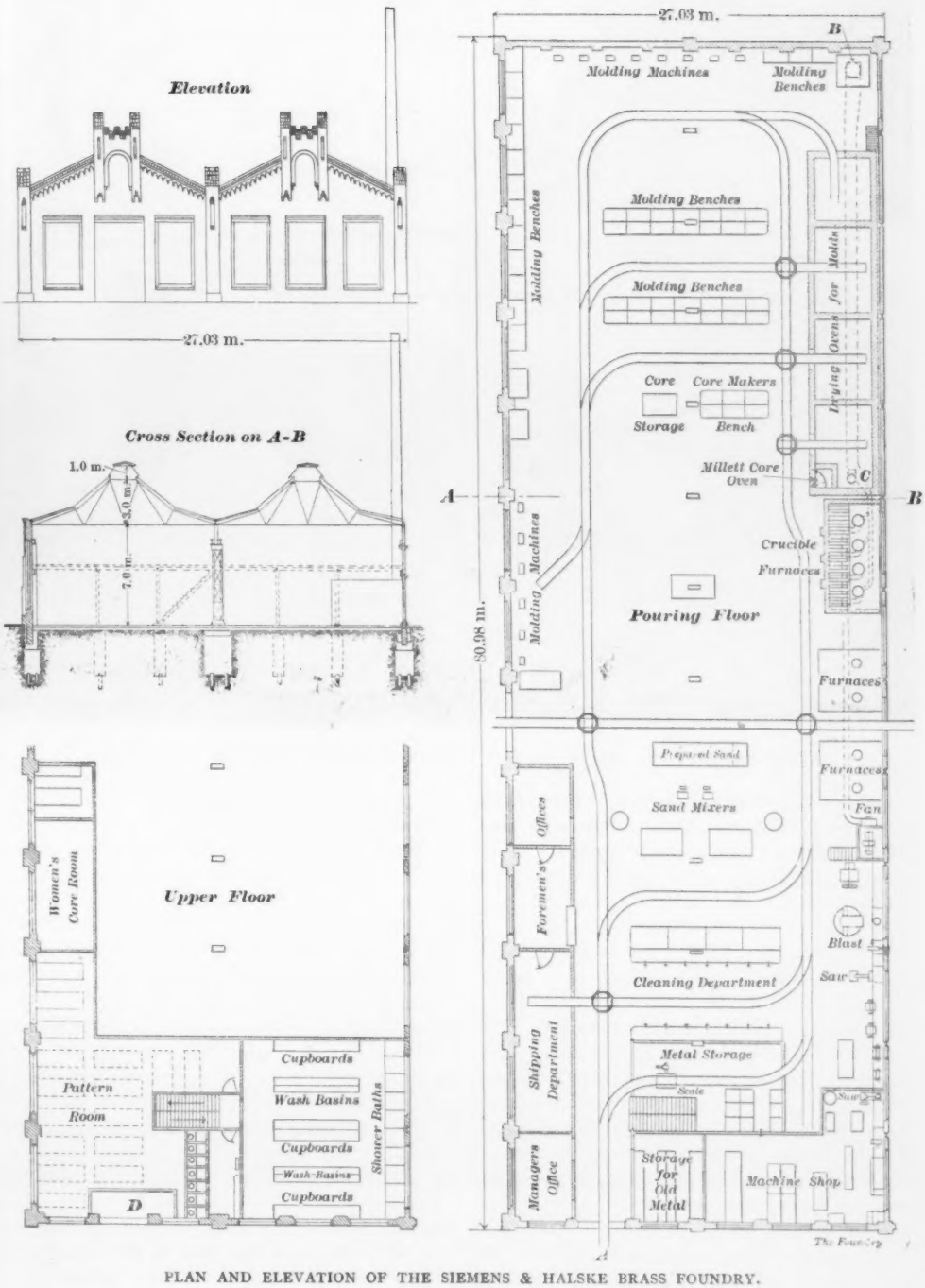


THE SIEMENS & HALSKE BRASS FOUNDRY.

The New Brass Foundry of Siemens & Halske.

As everyone knows, the German nation has made wonderful progress in the arts of manufacturing. Its aggressiveness is felt in every quarter of the globe and the workmen of its shops are commonly credited with being the most highly educated of any workmen in the world. The Germans possess great patience

NEW WORKS OF SIEMENS & HALSKE. BRASS FOUNDRY IN THE BACKGROUND.



PLAN AND ELEVATION OF THE SIEMENS & HALSKE BRASS FOUNDRY.

and many problems and tedious operations which would be entirely distasteful and tedious to the Americans are readily performed by them.

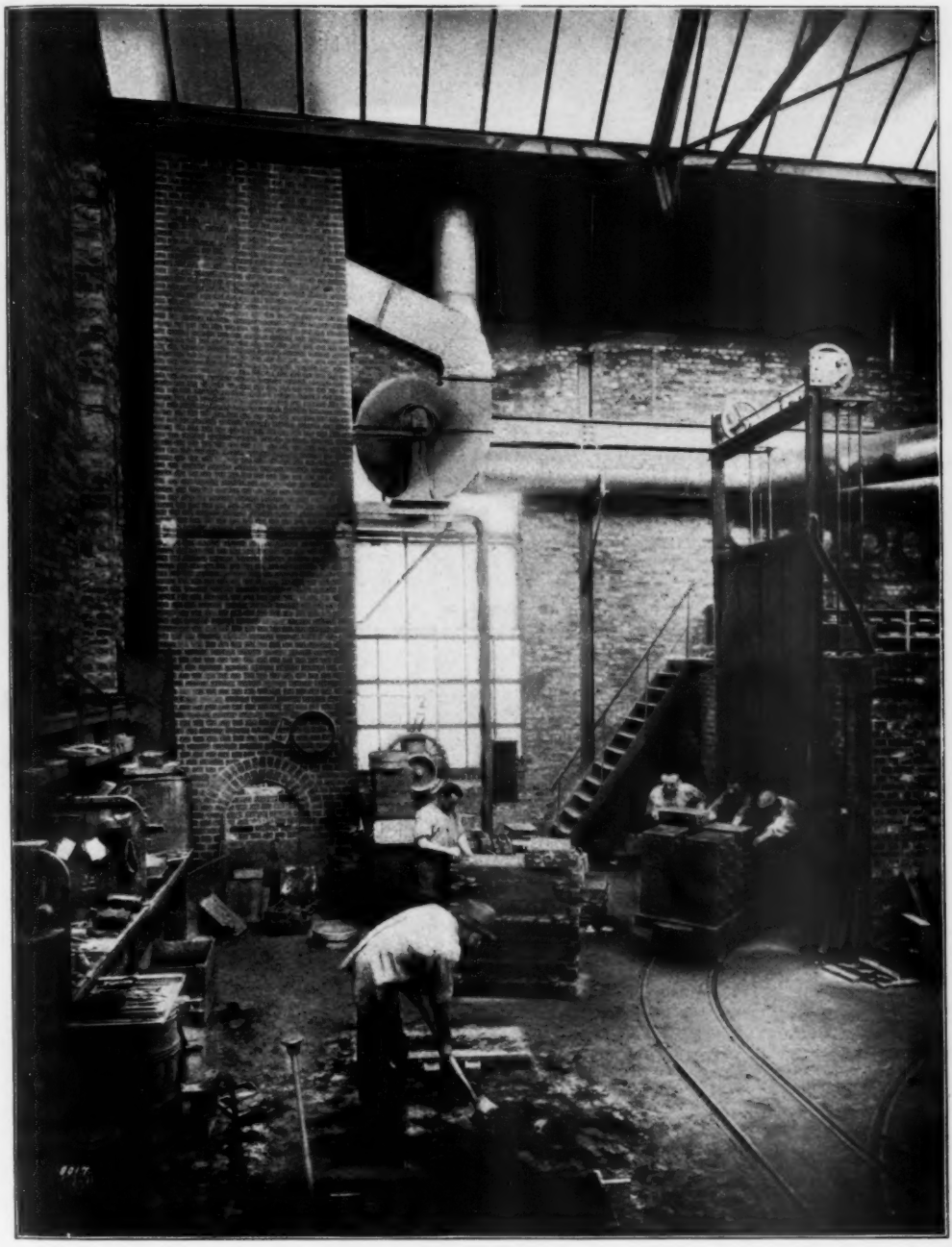
Among the German manufacturers of international fame we may mention Siemens & Halske, who, until the year 1876, were engaged in the manufacture of telegraph supplies. At that time they began the manufacture of submarine cables and also electrical machinery.

A PIAT FURNACE AND FAN CONNECTION AT THE SIEMENS & HALSKE BRASS FOUNDRY.

In 1886 the firm removed their manufacturing quarters to Charlottenburg, where Dr. Werner Siemens thought sufficient ground was available for all future needs of the corporation. At that time he also made a present of a part of the grounds to the German government on the condition that the well known Physicalisch-Technische Reichsanstalt (official testing laboratory) should be built there. The value of this amounted to over a million marks. However, but a few years passed until the development of the electrical industry required a second removal. It was necessary that this should be provided with the best of shop facilities and be located within a reasonable distance of Berlin. The further the new site should be removed from this center of industry the greater would be the necessity of supplying dwellings, schools, and other facilities for the thousands of men, who otherwise would be compelled to spend considerable of their time in reaching their place of work. The importance of this factor will be the better understood when it is known that Siemens & Halske in their wire works and manufacturing department for electrical machinery employ over 6,000 men.

On the northern bank of the River Spree, between Charlottenburg and Spandau, lay a tract of untilled lowland containing between 50 and 60 acres, which, at highwater, was entirely overflowed, and before occupation would have to be graded and raised up to prevent damage during high water. Difficult and expensive as this undertaking was it was accomplished and the advantages and facilities of the new location show the wisdom of its choice. A private canal, a branch of the Spree River, was made and affords harbor in private waters for all water traffic.

We show with this some illustrations of the new brass foundry of Siemens & Halske. The raw material enters at A, and passing over the scales is stored in that part of the foundry set apart for this purpose. In the storage room for old metal all scrap and rubbish are assorted and classified. It will readily be understood that a concern like Siemens & Halske receives great quantities of old copper, copper wire and brass goods; and that considerable more money



ONE OF THE DRYING OVENS IN THE SIEMENS & HALSKE BRASS FOUNDRY.

is made out of this old stuff by changing it into castings than there would be in disposing of it to dealers. From the storage rooms material is carried by a Hunt's industrial railway system to the melting furnaces. This company has in use four Piat furnaces, each having a capacity of 150 kilograms, or about 330 pounds. There are also four crucible furnaces which will each accommodate crucibles holding from 60 to 100 kilograms. A direct coupled Sturtevant fan delivers blast through an underground pipe to the furnaces. The escaping gases from the

Piat furnaces are conducted through hoods to the exhaust fan, the outlet of which is above the roof. The gases from the crucible furnaces pass through an underground flue to the chimney B.

The sand is mixed and prepared in a space set apart for this purpose which contains two motor driven centrifugal sand mixers. As is well known, the latter are provided with a cast iron hood which we prefer to provide with a rubber curtain, against which the sand will be thrown. In this way the wet sand will never adhere to the umbrella cover, as the rubber curtain receives, through the revolving of the machine, a vibrating motion which prevents the sand from sticking thereto. Two Gould & Eberhardt sand sifters are also in use as well as a facing grinder made after the Schwab pattern. The prepared sand is carried to the benches and molding machines by cars. As the majority of molds are dried, four ovens are provided for this purpose, the molds being dried over night. There is also a Millett core oven in the immediate vicinity of the core makers' benches. Separate shelves are provided for the storage of cores. The room above the ovens for drying the molds is utilized for the storage of crucibles and matchplates used in machine molding. At C there has lately been placed a large motor driven fan for exhausting the gases escaping from the Piat furnaces. Formerly it was attempted to conduct these gases through an overhead pipe to the chimney, as this pipe in the winter time assisted perceptibly in heating the foundry, but as the natural draught of the chimney was not strong enough, the installation of the fan was determined upon. This fan has two entrances, (the belt from the dynamo passing through two small slits in the pipe) one for the large pipe which connects with the four hoods of the Piat furnaces and one for a pipe leading to the drying ovens for molds, an inlet being provided from each chamber. Each inlet to the fan may be closed by a valve, and after the ovens are filled at night with molds and the fires started in same the fan is employed for some time in assisting to exhaust the heavy, damp gases produced by the molds. For 15 or 20 minutes this is kept up and helps considerable in drying the molds and it has been found that by this method all may be dried

ARRANGEMENT OF MOLDING BENCHES AT THE SIEMENS & HALSKE BRASS FOUNDRY.

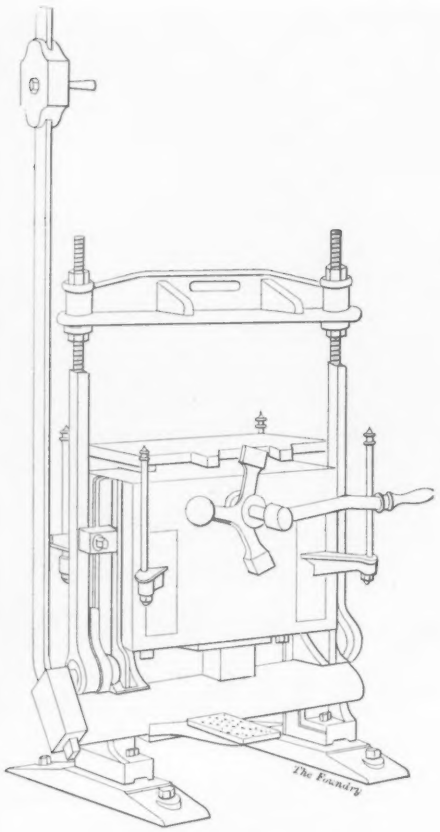
POURING FLOOR IN THE SIEMENS & HALSKE BRASS FOUNDRY.

completely during one night. The cost of running the fan for 15 or 20 minutes is so small that it is more than compensated for in the improved results which are obtained from the ovens.

From the ovens the dried molds are conveyed to the pouring floor where a special set of men clean the molds, set the cores and make the flasks ready for pouring. At this plant the molders do nothing but molding. The cores to be used are stored in a space handy for those who put the molds together. When the molds have been poured they are carried to the place where the sand mixers are located and dumped. The castings are sent in the direction of the cleaning department where a sand blast apparatus removes all sand adhering to them while the sand from the molds is moistened, sifted and prepared to be used over again. After leaving the sand blast the clean castings are sent to a band saw or a special ingot and gate cutter, and from here they reach the emery wheels, of which there are six, and two small circular saws, before finding their way to the assorting room which is equipped with benches and vises. Opposite the end of the cleaning room is the shipping department where every facility is provided for classifying and weighing the castings to guarantee quick shipment. From his office the foreman may survey the whole shop, the walls being made of glass. A separate room is also provided for his two assistants who from this point distribute orders and control the deliveries of castings. The manager's office is next to the shipping department and is provided with room for two clerks.

Attached to the foundry is a complete machine shop where the matchplates and other fixtures for the molding machines are made and repair work executed. This department also contains a motor for supplying power throughout the foundry as well as an air compressor for the sand blast apparatus and other pneumatic tools. Different machine tools are also provided as well as a blacksmith shop, and it has been found very convenient to have these departments in close proximity to the foundry.

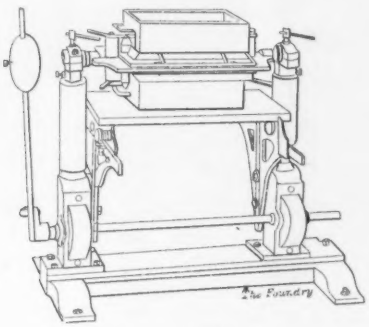
Provision has been made for the installation of traveling cranes, as it is possible that in the future heavier castings may be demanded and everything is therefore so arranged as not to interfere with plans in this direction. On the upper floor are located toilet rooms, shower baths, wash basins and cupboards, where the workmen may leave their clothes during the



MOLDING MACHINE, TYPE A.

day. At D is placed a Sturtevant heating and ventilating apparatus. The main pipe is laid through the middle of the foundry and fastened to the columns, an outlet being provided at each column. The air is renewed three and one-half times per hour. In the upper part there has also lately been located a core room in which girls exclusively are employed. They make the small cores quicker and at half the price which would be paid to men. We also find that the girls do not ram the cores as hard as the men do and that we have less blown castings from their cores. If occasion requires, the upper floor may be extended the whole length of the foundry, the shop being laid out so that the foundry itself may be extended at any time.

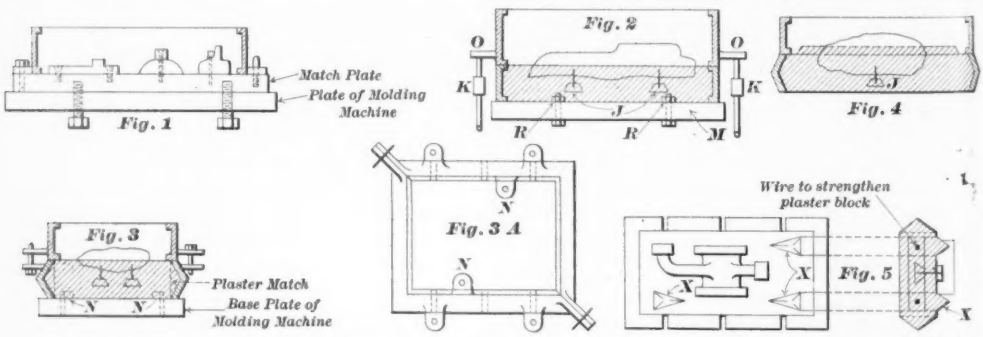
The plan of the foundry shows the location of the molding benches as well as the molding machines. Of the latter there are sixteen in



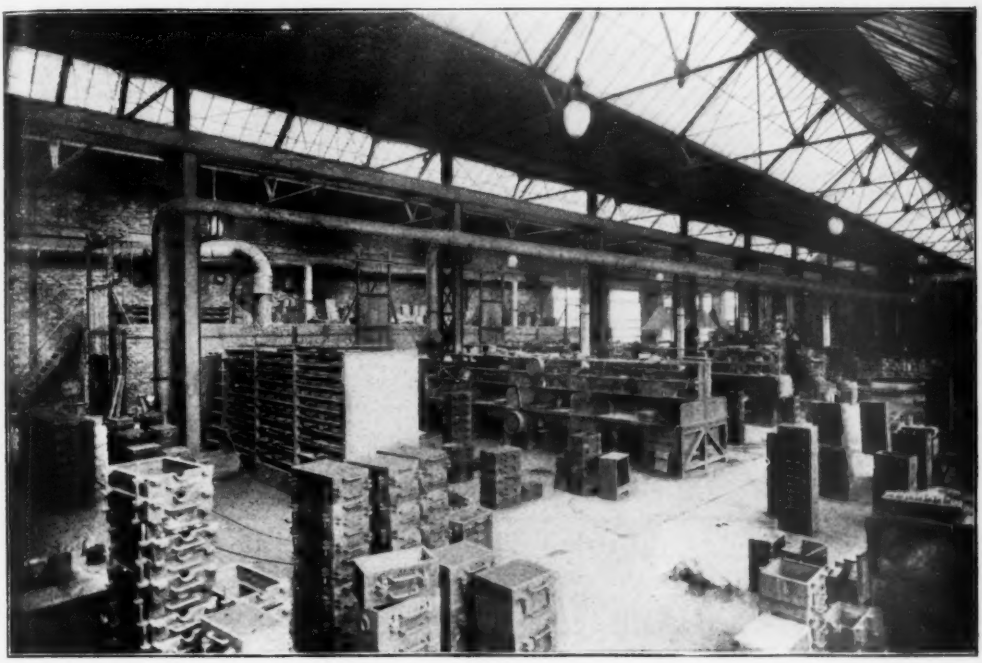
MOLDING MACHINE, TYPE B.

use. Among these are two Pridmore machines. The majority of the molding machines are of the old simple type, shown in the attached illustrations. We find that the one with the long lever is better adapted for small castings while the other is superior on larger work. Type A is therefore much better liked in the brass foundry, while type B is universally preferred in the iron foundry. At the present time the iron foundry connected with the Berlin works of Siemens & Halske is a small affair but plans are now being prepared for a much larger one, which it is expected will be built in the immediate future.

For our molding machines we formerly followed the method of fixing all the patterns on



METHOD OF MAKING PLASTER MATCHES FOR MOLDING MACHINES AT THE SIEMENS & HALSKE BRASS FOUNDRY.



VIEW IN SIEMENS & HALSKE BRASS FOUNDRY. DRYING OVENS AND FURNACES IN THE BACKGROUND.

a planed iron plate, after the same fashion as has often been described in the columns of THE FOUNDRY, and shown in Fig. 1. We soon found, however, that when the pattern could not be divided on a straight line that it was pretty expensive to work out the irregular curves in metal. Instead of using a matchplate for such patterns we adopted the system of making plaster matches or follow-boards for same as shown in Fig. 2, the plaster block being held in a frame, similar to a part of the flask and fitting with the latter in the matter of pins and pin holes. By using fine sand for the mold and a special mixture of plaster of Paris we found it possible to obtain very good results and through this method the cost of a matchplate was cut down to from 12 to 20 marks against 100 to 200 marks for an ordinary metal plate. To keep the pattern safely in place in the plaster block, several "swallow tails" J are screwed into the pattern before the plaster is poured thereon. If it is desired to strengthen the plaster block one may insert some pieces of wire in this. The frame for the plaster match has two ribs R, R, by which it can be fastened to the base plate of the molding machine M. At both ends of the flask are projecting pieces O, O, upon which the lifting mechanism of the machine acts. The latter may be adjusted through the screws K, K.

While our system of using plaster matches, instead of metal matchplates, as originally adopted and previously described, showed a great saving we were not satisfied as a great many frames had to be fitted up, since these could only be used for one pattern, and when this was not in use, the frame was also idle. We therefore arranged to use instead of a solid frame the frame shown in Fig. 3 and Fig. 3 A, which is built on the principle of a snap flask and may be removed from the plaster block at will and used for any number of these. When an order is completed this match frame can easily be released and as readily re-attached whenever an order is repeated. With the style of match shown in Fig. 2 everything, pattern, plaster block and match frame, has to be stored after the castings asked for are finished, while with the form illustrated in Fig. 3 only the plaster block with pattern has to be stored. In other words, with the rigging shown in Fig. 2 the frame is an element or constituent part of the match, whereas when used as in Fig. 3 it becomes a part of the molding machine itself. The "snap" frame is fastened to the molding machine through the lugs N, N, and has the common pins and holes for guiding the flask.

As nearly all of our molds have to be dried it will be readily seen that even with the best made flask pins and holes for same these are

Bl. No.

Besteller Zchg. No. Modell No.

Bestellung — Anfrage vom .....

Gegenstand: Legierung

Gewicht pro Stück kg Rohguss; fertig bearbeitet kg

Formerlohn pro Stück Mk. d. i. pro % kg Mk. Masch.- – Hand-Formerei

Kernmacher „ „ „ „ „ „ „ „ „

Einsatz

Preis pro Stück Mk.	Datum	

FACSIMILE OF COST CARD EMPLOYED IN THE SIEMENS & HALSKE BRASS FOUNDRY.

DINING-ROOM ATTACHED TO MAIN WORKS OF SIEMENS & HALSKE.

THE FOUR PIAT FURNACES AT THE SIEMENS & HALSKE BRASS FOUNDRY.

soon worn out sufficiently to cause considerable shift and will not give a really perfect joint. To overcome this and to assist in obtaining a good casting we make the parting of the mold of a conical shape as shown in Fig. 4, deepening this in the drag and elevating it in the cope to the same degree. The same result may be attained by building three or four conical elevations as seen at X Fig. 5. The latter illustration shows the appearance of the plaster block after it has been removed from the match frame. We figure that the cost of such a plas-

ter match comes only to 6 or 10 marks, an expenditure which is saved almost every time on the first order by lessening the expense of molding. In my opinion this is the cheapest way to prepare a pattern for the molding machine.

At the Siemens & Halske foundry, piecework prevails as much as possible, the molders being paid a certain amount for each kilogram of good castings delivered in the shipping room. With the larger class of castings the molder is paid according to their weight, while with the smaller castings, of varied intricacy, it has been found more satisfactory to pay for their molding by the piece. The men who prepare the dried molds for pouring receive another percentage, as do also the men in the cleaning department, the whole amount being equally divided between the men of each department. In this way everyone is interested in producing the best results. The attached reproduction of a record card, shows the system in vogue for obtaining a detailed statement of the cost of producing castings. These cards furnish the foundry foreman information relative to the department and give the timekeeper the necessary data for his payrolls. Finally the manager is through them kept in close touch with the progress of the foundry.

We also show with this an illustration of the dining-room attached to the main works of Siemens & Halske, which has a seating capacity of 1,200 and is 16 meters wide by 80 meters long, and provided with the most modern steam cooking apparatus. This dining-room is of considerable benefit to the men who would be unable to reach home and return to work even with two hours allowed at noon day, or else would be compelled to eat cold food brought from home. When the new plant was laid out it was therefore arranged to have three-quarters of an hour for dinner and to have all the men quit work in a body in order that they might partake of the warm dinner prepared for them. Special ovens are also provided in which they may warm food brought from home.

While many attempts have been made to reduce the cost of our molding we must confess that we are experiencing some trouble in getting out orders as fast as we would like to do. The strong competition which has existed in every line in the past few years has resulted in not only making all patterns more complicated and of considerable less weight, but cores have been applied in such quantities that whereas three years ago the ratio of molding to core making was 10:1.5 this has changed now so that the cost of cores is about one-third against an expense for molding of two-thirds. At the present time, therefore, our main attention is given to core making. Three years ago we paid on an average 10 marks for the molding of 100 kilograms of castings and 1.50 marks to the coremakers. During the last year the expense for cores for the same amount of castings has averaged 3.50 marks.

In order to have a good view of the foundry from any one place it was decided not to divide the building into single compartments but to have one big open room, the few partitions needed to be made of glass. Since the molding, melting and pouring was to be done in one room, we paid special attention toward securing the very best ventilation. We find that the original plans meet all our expectations and that what we have accomplished has not only succeeded in meeting the severe demands of our government trade inspectors but has also on every hand received the compliments of our workmen.

PAUL WEVER.

CHARLOTTENBURG, GERMANY.

Cost Keeping in Foundries.

I have read with considerable interest the numerous articles which have recently appeared in the columns of THE FOUNDRY on this subject. I have also examined the several cost sheets which have been appended to these articles, a number of which were very minute in detail and purported to be very accurate in determining the cost of producing castings.

After reading over all of this material, and studying it very carefully, it appeared to me that foundry practice must be advancing at a very rapid rate when it is getting down to such very fine systems, and in order to convince myself that such is actually the case, I started out to learn how these "Cost Sheet Theories" worked in practice.

At the first foundry visited, I found that a time card had been introduced upon which each molder was required to put down the time spent in molding each piece, the number of castings molded, the number of good and bad castings made each day, besides numerous other things. When this system was first introduced the molders objected to filling out these cards, and when the firm insisted upon their doing so, the molders promptly went on strike, which resulted in

a foundry, filled with good mechanics accustomed to its work, exchanging these for a set of molders, such as can find employment only when times are good and workmen scarce. Of course the old men had no trouble in securing employment in other foundries. The foreman of this shop informed me that with the new shop crew they were making more bad castings in a day than they had formerly done in a year, with their old and tried employes. Even such castings as were passable were not up to the former standard and the cost sheet had really not proven a success in this foundry.

At another foundry the firm had introduced a time card, similar to the one mentioned above, which every molder was required to fill out and return to the office at the end of his day's work. In this instance no trouble had been experienced in having the employes do as requested, but when examining the various items they were found to be so mixed up and so inaccurate that they were not intelligible, and were therefore of no value in estimating the cost of producing castings. At this point the foreman was instructed to see that the cards were properly and accurately filled out, to which he replied that he had no time to fill out cards for a hundred molders every day, and that he would require an assistant for this work if it had to be done. A clerk was then detailed from the office to look after the filling out of these cards, which, among numerous other things, required that the time taken to mold each piece should be put upon the card, so that the cost of molding each casting might be accurately determined.

In order that a molder might know the time at which he began to mold a certain piece and the time he finished this, without loss of time, numerous clocks had to be placed around the foundry so that each molder might observe the correct time without leaving his floor. After all this had been attended to, it was found that the molders only put down the time actually required to mold a piece from the time they had the pattern and flask on the bottom board ready to receive the facing sand until the mold was closed. This did not account for all the time of a molder working by the day, as he omitted those periods when he was getting everything ready to make a mold, pouring off, shaking out, etc. All of this time had to be divided up by the time clerk and charged to each casting, all of which required a great deal of time and labor, and the clerk's time was entirely taken up in keeping track of what the molders were doing, charging off bad castings, and estimating the average time required to mold good castings. All of this had to be done on the elaborate time card of each molder; besides this, the clerk was charged with the duty of looking after the time cards of core makers, and other foundry help.

After learning these facts from the foreman of the foundry, I went to the main office to ascertain what disposal was made of the time cards when they arrived at this place. Here I met the president of the company, who very kindly explained to me their entire system of cost accounts. An elaborate set of books had been prepared with printed headings and rulings, somewhat after the style outlined in some of the blank cost sheets, of which facsimiles have recently appeared in the columns of THE FOUNDRY. A separate account was opened with each contract, order for castings, or work being constructed in the machine department for which castings were required. When the daily foundry time cards were handed in, each casting was charged to its proper account, together with time of molding, core making, cleaning, etc., and the cost of same. The cost of iron in the castings was figured out, as was also every item of cost included in the making of castings from the time the pattern reached the foundry until the casting was delivered.

In order to ascertain these various items and maintain this cost account, three clerks were required; one at the foundry to fill out the cards, and two at the office to figure out the details and record these in their proper places. The cost of doing this work was estimated at $2,000 per year. I inquired of the president if it paid to keep this account, and he replied that it certainly did, for before they had done so they did not know what the castings were costing them and now they had only to turn to the books to learn at once the cost of any particular casting or lot of castings, and that this was a great advantage in figuring on contracts for new work, etc.

I might have told him that his cost keeping system did not accurately show the cost of his castings, and that even if it was more or less elaborate, it was really only a useless expense which added to the cost of the castings. However, had I done so he would probably have set me down as being one of the old "Rule of Thumb" foundrymen, whom we so frequently hear about. And why should I disturb his peace of mind when he was satisfied with himself and his system? In time he will learn the folly of it all, as others have done, and the world will move on just the same.

The keeping of daily cost sheets is only boys' play, such as almost every young man indulges in, when he first goes into business for himself and attempts every night to figure out his profits on the day's business. This he soon finds to be impossible unless he is ready to take account of his stock on hand every night, and in the end he is compelled to adopt the old and well established system of taking stock once a year to ascertain his profits. The same is true as far as the daily foundry cost sheet is concerned, for no founder ever uses up his supplies from day to day, and to prepare an accurate daily cost sheet, an account of stock on hand will have to be taken every day. After this has been done a daily cost sheet can only be partially correct and to a large extent it is more or less guesswork.

But suppose a system should be found by which the daily cost sheet can be made perfectly accurate, of what value would this be to the founder? Is not one daily cost sheet simply a repetition of the previous day, and the cost books of one year's business a repetition of that of the previous year? Do such accounts enable founders to produce castings at a less cost per pound? They do not, but instead increase the cost of castings by the additional expenditure included for clerk hire, books, paper, printing, etc.

Not only does the daily cost sheet increase the cost of castings by increasing other expense accounts, but I found in a number of foundries visited, that in some of these the introduction of molders' time cards had caused strikes, and in others a spirit of dissatistaction among the molders which was even worse than a strike.

In some of these shops the molders thought they were being watched with a view of putting them on piecework later. They were evidently of the opinion that their rights were being imposed upon and their liberties in the foundry taken away from them, therefore everything possible was being done to knock out the time cards. In some instances cards were filled out wrong and in other cases work was slighted to make a big showing. Bad castings were reported as good ones and the time was not fully accounted for, cards were covered with blacking and dirt after they were filled out, so that they could not be distinctly read, and everything possible was done to render the system worthless. It was only by employing someone to visit each molder and fill out his time card that these could be gotten into any kind of an intelligible shape.

The invention and introduction of the foundry time card and cost sheet system of the present time is the work of the younger element in the foundry business, whom we so frequently hear remark: "We know the cost of our patterns, machine work, etc., but we do not know anything about the cost of our castings, and we cannot find out what these do cost us?" These young men are probably not aware of the fact that the foundry cost sheet system was thoroughly tried in this country and abandoned before many of them were born.

Probably the most complete and perfect cost sheet of this kind ever arranged and kept by a founder was the one prepared and kept by Mr. John S. Perry of Albany, N. Y., the leading stove founder in this country, and probably in the world, some thirty years ago. Mr. Perry not only included in his cost sheet the cost of patterns, flasks, molding, melting, cleaning castings, iron, sand, blacking, fire brick, clay, tools and all foundry and shop supplies, but he also took account of money invested in the plant, insurance, repairs, depreciation in value of patterns, flasks, machinery and plant; foreman, office clerks, bookkeeper, books, stationery, salesmen, bad debts, in fact, every possible item was kept track of from the time stock was purchased until it was manufactured, sold, and money received for it.

One item that attracted my attention when looking over his list of printed headings was that of "petty stealings." Upon inquiring as to the meaning of this he informed me that after he had learned that the wives of some of his workmen had been

selling him files, stolen from his pattern or mounting shops, when $50 worth of pattern letters had been used in lettering two sets of stove patterns, and a barrel of molasses had been carried off in the dinner pails of his workmen during a few days, he had concluded that petty stealing was quite an important item in the cost of castings and he had therefore included this in his cost system.

When I asked him if he had found that it paid to keep this cost sheet he replied that it had not, that after keeping it up for a number of years he had not been enabled thereby to decrease the cost of his castings, but instead had to show an increase to the extent of the expense involved in keeping this account, which was considerable, and for this reason he had abandoned the system.

I met a number of other founders about that time who had also prepared and kept elaborate cost accounts, but all of them had given these up, as they, like Mr. Perry, had found that they did not enable them to decrease the cost of their castings, and it will probably not take very long for those determined to keep such accounts at the present time to arrive at the same conclusion, especially so, since the systems now being advocated appear to me as being more complicated and less accurate than those which were tried by founders years ago.

The ascertaining of cost of castings is a very simple and inexpensive matter when undertaken in the proper way. The bills for all foundry and pattern shop materials are received at the office, the payroll for all men employed in the foundry or in connection therewith are made out at the office, and the bills for all castings sold come from the same source. By opening a foundry account and charging the foundry with all money paid out for it, and crediting it with the weight of all castings turned out, and then taking account of the stock on hand, the cost of castings per pound can be accurately learned for any given period. This may be done once a year or every six months, or every month, if desired. If one wants to learn what is the cost of any particular item of a casting, such as melting, molding or patterns, it is only necessary to open separate accounts for these items, charging them with all money paid out for such and crediting them with the weight of castings sold.

All of these accounts may be kept from data on hand at the office without ever going into the foundry, except when it is necessary to take account of the stock on hand. If it is desired to learn the cost of any particular casting or to ascertain if each molder is turning out a fair day's work for his wages, this may be done by the old and well established system in stove foundries, of sending a man into the foundry every day to take down in a book the number of castings, or weight of castings, each molder turns out, and charge him with bad castings found in cleaning. From this book the cost of molding any particular piece or line of casting may be readily ascertained. A record may be kept of each molder's work and poor mechanics weeded out. All of this can be done entirely independent of the molders and no deception can be practiced by them, or injustice done them, if the account is accurately kept.

Taking stock in a foundry is not nearly so difficult a matter as many founders imagine, for it is only necessary to take account of new stock on hand. All stock that has been once used in a foundry, such as shovels, riddles, sand, flasks, patterns, etc., if sold when comparatively new, would not bring ten per cent of their cost, and they are eventually consumed in the foundry, and have to be replaced by new ones, and therefore may as well be charged to the foundry or cost of castings at one time as another. All machinery, such as engines, blowers, elevators, tumbling barrels, etc., should be charged to plant or foundry machine account and invoiced at from 25 to 50 per cent of their cost.

By taking account of stock in this manner the actual cost of castings and also the probable available assets of the foundry may be accurately estimated. Should it be desired to make a better showing than this plan will allow, patterns, flasks, machinery, etc., may be credited as assets at their cost price, and a certain percentage charged off each year for depreciation in their value. The keeping of a cost account of castings in this way will very likely be found more accurate and less expensive than by means of any of the cost sheets recently published.

EDWARD KIRK.

Two Failures.

Figure 1 is an addition to the already long list of burning jobs, described and illustrated in the columns of THE FOUNDRY, and shows how a job may be a success as a burn, and yet, as a direct result, the casting is wasted. In this instance the casting is a half table for a printing machine, roughly about four feet square. The grooves shown are closely gaggered to support the green sand, and occasionally, as a result of wet sand, or the metal finding a gagger, the casting will blow over the ribs more or less as shown in the illustration. When the space involved by the blowhole is short, and not more than two or three inches in length, the burning presents no difficulty. In this particular instance, however, it was required

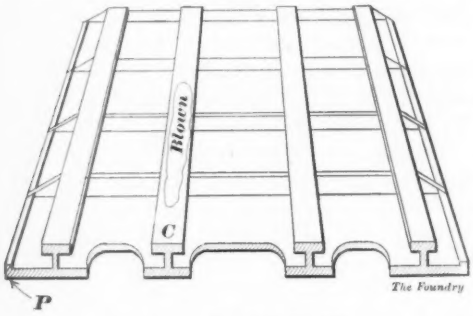


FIG. 1. A JOB OF BURNING.

to make solid a blowhole which extended for about two feet along one rib and it was determined to make an attempt to burn it although we had never made burns of such a size before. The casting was prepared in the usual manner save that instead of ramming around the diseased spot with dry sand facing, we concluded to use loam with the idea that this material would stand the fire better. The casting was run into the drying oven over night, a good fire made up, and as there was nothing else in the oven the casting had the full benefit of this, the loam being burnt black when the casting was brought out.

Just before the blast went on the next day, a bed was leveled, and four trenches dug therein, one to come under each bowl flat. The casting was brought from the oven and set down on this bed and about two cwt. of iron poured into each trench, with the idea of thoroughly heating the casting. The surface of this iron was about 14 inches below the bottom of the casting, and after the latter had been subjected to this heat for about ten minutes, the crane ladle with twelve cwt. of iron was brought up and the job burnt, the overflow running off at the end C, thereby involving three-quarters of the rib which was defective. After the burning had taken place the casting was again run into the oven to remain until morning so it could cool off gradually. When it was cooled off it appeared that a first-class job had been done, and it was sent into the machine shop to be planed, bottom side first. One would naturally suppose that, knowing this to be a patched job, someone, either in the foundry or the machine shop, would have tried a straightedge the first thing, but it was bolted on the planer without this being done. Planing commenced from P, and all went well until drawing near that part of the casting immediately over the burnt rib when the tool was taking such a cut in the middle, as to almost stop the planer, and yet not touching the casting at the end over C. On examination it was found that the contraction of the rib which had been burnt had bent the table more than one-half inch in its length, pulling up the end C till it would not clean up and the casting was consequently scrapped. It may be possible to burn such a job as this, and keep it straight, but the odds are against it.

Figure 2 shows a method of overcoming shrinkage strains. The casting shown in the illustration is a blank for a cut gear for a printing machine. It is about six feet in diameter and the rim section is about three inches square with a filleted rib on the inside. Of the first three cast, two cracked in the rim after a goodly number of teeth had been cut. The experiment of baring the rim immediately after the casting was poured was tried, but without success, save that the fracturing was delayed until more of the teeth had been cut, thereby causing greater loss. The casting was run with a flat runner dropped down on each arm, which was of cross section, with the idea of getting the hottest metal in the arms. It will be obvious that this was a casting which was entirely too costly to try many experiments on, so a method was decided upon which, while allowing the wheel to break, should make the break of no detriment. The lugs L were added to the casting, these to be cut through in the

machine shop and so spaced that they would come between two teeth. The first trial was rather unfortunate, as when the casting was taken out of the sand, no attempt to bare the rim had been made, it was found to have cracked at B, showing a gap

FIG. 2. OVERCOMING SHRINKAGE STRAINS.

of three-eighths of an inch. After this prints were added to the lugs, and splitting plates used, which proved a complete success, and I believe this method is still followed. Each casting showed about one-quarter inch opening at each side of the splitting plate, in addition to the space occupied by these. A hole was bored through the lugs and these fastened together by a strong bolt. The opening was filled with type metal, and the bolt tightened up before cutting of the teeth was commenced.

H. SAYERS.

The Austin Foundry Co. is erecting a foundry at Minneapolis, Minn. 54x70 feet. It is likely that the Austin, Minn., plant will be abandoned when the new works are completed.

According to reports the St. Paul Foundry Co., of St. Paul, Minn., will add a malleable department to its works.

The Buckeye Aluminum Co. has been organized with $50,000 capital stock, at Doylestown, Ohio. The company has bought out the business of the Bay State Aluminum Co., and the plant now located at Quincy, Mass., will be removed to Doylestown. A new factory will be erected.

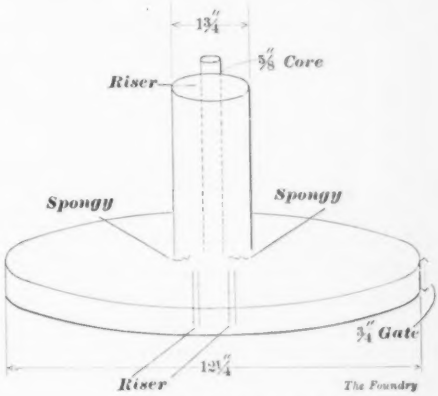
CAST IRON NOTES.

Devoted to inquiries from Practical Foundrymen on the subject of Melting and Using Cast Iron. Address all inquiries to W. J. KEEP, care of The Foundry.

SPONGY CASTING.

Question. After machining the casting shown in the illustration the surface is full of holes in the parts marked spongy. The central portion is very easily broken off. Will you kindly suggest a way to cast them? We pour these castings from the bottom part marked "gate" and take a riser from the top of the hub alongside the core by turning the flask over, and also pour off in the same place, and take two risers from the parts marked on the flat side of the casting, casting them and pouring them in the regular way.

Answer. I do not understand your description of risers and pouring, but you start out by saying that the sketch represents the position of the casting in the mold and that you pour the casting through the "gate" at the underside of the casting. I can see no need of the risers or of the pouring having any connection with the sponginess of the castings. A fillet around the base of the perpendicular part might help, but the iron entering the bottom of the mold flows over a surface 12¼ inches diameter and before it rises the ¾ inch the whole surface of the liquid iron would be covered with slag and with graphite. This



A DEFECTIVE CASTING.

surface iron will flow towards the space in the center and the dirt and slag would cling to the sides of the mold. The sharp edge would act as a skimmer. I would try and make the casting the other side up and pour through a round gate near the center, filling

the central portion first and covering the surface of the disc with clean iron and let any dirt lodge in the surface which is now the bottom. Most of the dirt would lodge in the gate. The gas would get off without risers.

CLAY IN MOLDING SAND.

Question. What effect will sand containing a great percentage of clay have on castings?

Answer. It is the clay that gives to molding sand its adhesive quality. It should not contain any more than enough to cause the mold to hold together and resist the iron. More than this amount will close up the spaces between the grains and prevent the escape of gas. The sand will not have enough vent. Such sand will stand very little ramming. The iron that runs over spots that are rammed hard is likely to be hard or to blow. The molder is supposed to riddle all of the sand that lies next the pattern so as to prevent any pieces of clay from coming in contact therewith. If any piece should be rammed through the riddled sand to the face of the mold the melted iron would not lie against it and a smooth pit would be formed on the surface of the casting.

CHILLED ROLLS.

Question. How can I by chemical changes of the different elements obtain a tempered or hardened carbon in the chilled roll? Roll makers use this expression referring to combined carbon.

Does an addition of ferromanganese to the bath in an air furnace increase the chill?

Why are sulphur and manganese considered the most important elements in chilled roll making, when in ordinary machinery casting silicon, carbon and phosphorus are most important?

Answer. The state of the carbon is regulated by the time the iron is exposed to the oxidizing flame of the air furnace. Chilling irons of the proper composition are placed in the hearth of the furnace and the silicon and a portion of the carbon are burned out until the iron reaches the desired composition, which is determined by tests from time to time. The chemical changes necessary to bring the carbon into the proper state take place in the furnace. It is not necessary to add ferromanganese unless to reduce sulphur, but the founder would select pig irons that did not contain too much sulphur. An addition of spiegel will harden the chill for stamp shoes, etc.

A chilled roll must be turned on its surface and is subjected to great changes in temperature when in use and sulphur and manganese must be low.

In machinery castings the melting is so rapid that there is very little change in the composition of the metal. Whatever is put in must come out and there is no time or way to make tests or to change the composition until it is just right as in the air furnace.

By adding silicon, the carbon is changed to graphite and the castings are made soft. Sulphur is increased in cupola melting.

In an air furnace from one-third to one-half of the manganese would be burned out. The sulphur and phosphorus would not vary much from that of the pig iron. The silicon will be decreased as much as the founder wishes and the carbon decreases also. A good composition for a completed chill roll is: T.C. 2.81; G.C. 1.71; C.C. 1.10; Si. 0.78; P. 0.50; S. 0.061; Mn. 0.21.

IRON CUTTING THROUGH CUPOLA BOTTOM.

The iron cut through every day near the tap hole. A too wet bottom was suggested, etc. Several days later the following was received:

"For a year or more our melter has been drawing the slag through the tap hole which worked all right for small heats but during long heats my opinion is that the wind has gradually blown the sand of the bottom out through the tap hole along with the slag and iron and let the iron reach the iron bottom plate and cut through.

"During the last six days the melter has held the slag in the cupola and there is no more trouble."

Limitation of Output by Molders.

BY JAMES A. MURPHY.

The restriction of output, the abolition of the level minimum wage rate and the adjustment of the present apprentice law on an equitable basis, are points that stand out very prominently in the deliberations of the National Founders' Association at the meeting recently held in Detroit. Without doubt the molders' organization cannot afford to ignore these questions very much longer, if it is to command the respect and confidence of foundrymen in general.

The restriction of output and its many ramifications suffice in nearly every instance to cover the multitudinous complaints of the iron founders. I have no sympathy whatever with the man or organization who is not willing to pay the molder decent wages consistent with his ability or will not offer him fair conditions

as to working time and healthful surroundings; but the interference of one man with another as to the amount of work each shall accomplish is intolerable in the majority of instances. I can easily imagine cases where a certain amount of interference may be just, but as a general rule this setting of a "day's work," beyond the confines of which no one dares to go, is antiquated and nonsensical in these days.

That the Molders' Union as an organization at the present time is in favor of a restricted output I have good reasons to doubt from many cases which have come under my personal observation during the past few years. I believe that as far as restriction goes this is rather a sentiment confined for the greater part to the floating element in the union, which is hard to control. In its action it is antiquated and unjust, to be sure, but firmly established just the same. Some of the molders who come under this classification even go so far as to try to influence apprentices to do only half as much work as a molder and through this they probably often succeed in getting some poor boy discharged by the foreman who is not on to this kind of a game.

There is every evidence that a good many of the molders are becoming more liberal in their views and are beginning to see things in a broader light. The sooner shop committees and other functionaries stop telling the molders in the morning how many castings of this and that pattern are to be considered a day's work the better it will be for the molders themselves. What the Molders' Union should do is to embody a clause in its constitution forbidding locals, under penalty of forfeiture of charter, to fine, suspend, expel or in any manner censure any member for the reason that he may have accomplished more work in a day than some one else, or as it is rather euphemistically called "killing the job."

It is hardly to be denied that there are hundreds of unprincipled employers who neither could nor would be satisfied under any conditions, but it is still more difficult to ignore the fact that there are thousands of molders who could never do too little to suit themselves and these are constantly dinning into the ears of honest workmen their principle of doing as little as they can for the most wages they can get, often winding up the argument in favor of this with the exclamination, "I will be as rich as the end of the year and receive as many thanks as those that kill themselves."

During the past few years I have on several occasions discharged men for not doing enough work. If I have improved the rigging or method for turning out a certain casting I have demanded that the better facilities should show an increased output, although never asking for anything not easy of accomplishment. If I did not receive anything in return for better facilities I have invariably followed the policy of discharging men until I received what in my opinion was an honest day's work, and I must say in justice to the local as well as the National union, that though they were importuned to take up the cudgel for these molders who refused to take advantage of improved appliances, they unhesitatingly maintained a vociferous silence.

To cite one case: We had certain wheels in our shop on which there has been a "set day's work" for a number of years. Some time ago I had an opportunity to lower the cost of producing these castings through getting up a better rigging, by which less time would be required in molding. Therefore I went to considerable expense, expecting to reduce the cost of molding at least 25%. At the time of starting this improvement I did not imagine that I would have to employ much strategy to carry out my ideas, particularly as the molder working on these castings was a resident of the city and apparently a steady and honest workingman. My surprise came later on when he positively refused to lower the time required in molding these castings, in the face of the fact that he did not have near as much work to do as before. As these castings were a particular sort of job and had to finish up clean all over, no two being alike in every detail, being made to accommodate different styles of governors used on the engines, there was great liability of mistakes being made by anyone but a molder acquainted with the job. I therefore compromised at the time by receiving a slight increase in the number of castings turned out of the larger sizes. This compromise, though unsatisfactory to me when it was made, gave me time to think out a way of overcoming the difficulties confronting me; and while the molder was no doubt tossing bouquets at himself over his victory I unceremoniously removed him, bag and baggage, one evening, and put a man in his place shortly after that who did so much better that I really reduced the cost of molding these castings more than I had originally expected to do. I have reduced the molding time on several

jobs from 10 to 80 per cent from what I found it in several foundries, and never have I had any trouble with the union. It is to be admitted that strategy must at times be employed by the foreman, for in many instances he is the maker and unmaker of trouble and oftentimes has more points up his sleeve for the betterment of conditions for all concerned than either proprietors or molders are aware of.

The minimum wage rate as at present enforced is fundamentally wrong. Just so sure as there are many molders who are worth twice the figures which are fixed, just so sure is it that there are several who are not worth half of what one is forced to pay them. Some of the latter are not worthy of being considered in the category of molders at all. On this account there should be a differential wage rate. The snap and bench molder can never be considered worth as much as the men who make castings weighing thousands of pounds.

It has been my fortune in common with hundreds of other foundry managers to be compelled to hire men from time to time whose qualifications as workmen are unknown. Invariably I have found that on first-class work 90 per cent are not worth, in a machinery foundry, the room taken up by the soles of their shoes. These are the fellows who do the most sputtering about "union principles" etc., when the wonder is that any reputable trade organization should grant them a card, which enables them to bunco several foundries before they strike a shop having a class of work which they can do. I never pay such molders the minimum wage rate, but generally size them up quickly and allow them what I honestly think they have earned, when I let them shape their course for some more propitious spot. The union has never caused me any trouble because I followed this course, indeed I do not believe that it really expects such incapable workmen to receive mechanics' wages.

While it is true that there are establishments watching every chance which offers to take a small technical advantage of the men employed therein, so will one also find a set of men who are all the time watching for an opportunity to take advantage of the firm. We hear considerable about the foundry foreman who is always taking advantage of his men and attempting to increase the output by unreasonable means, but is he any worse than the molder who with the connivance of the balance of the men in the shop, and perhaps a new local union, starts in to fool the boss on the time required on a new job, by ramming up courses of sand which are not over 3 inches deep? I have seen men put in a week on a job that could easily be made in two days, and in cases where the foreman is not an experienced molder he becomes a lead weight around the neck of the firm. Taking advantage of one another breeds distrust and contempt on both sides and gives rise to that discontent which sooner or later, volcanic-like, ends in open rupture to the ultimate loss of all concerned.

The golden rule, common, rugged, insistent honesty, mutual forebearance and a proper wholesome respect for the rights of each other will go farther towards promoting good feeling, harmony and liberal shop output than all the artful red tape, hide-bound agreements, rules that are never read or obeyed, and other formulas which some people believe are necessary to the proper management of an establishment. With the introduction of superior facilities for turning out castings, let these be machines, improved flasks or other shop riggings, the firm is justly entitled to receive more castings and the molder who refuses to do what is honest, or quits because he has to, only injures himself, his shopmates and his organization. He is just as bad and no worse than the fellow who keeps telling everybody else that they are doing too much. I always make it a rule to discharge anyone who interferes with another in regard to the amount of work he does, if I can by any means prove this to a certainty.

Modern Cupola Practice.

The cupola, a vertical cylinder lined with brick, is a model of simplicity. The modification in the designs of cupolas during recent years is very marked in the right direction for fast economical melting and includes: 1. Decreasing the diameter and increasing the distance between the hearth and charging doors. 2. Having a blast belt connecting double or triple rows of tuyeres. 3. Internal modifications of lower part of cupola and tuyere arrangement.

The old style cupola is lined with fire brick and bosh blocks, narrowing at the tuyeres, with a distance of about eight to ten feet from bottom plate to charging door. This practice continues in many foundries today.

The advantage of decreasing the diameter of the cupola and lengthening the distance between bottom and charging door is readily seen when fuel and comfort are considered. The charging door should be at least from 14 to 16

feet above the tuyeres in order to utilize the heat not directly expended in the melting zone to heat the descending charges of iron about to be melted, and keeping a low temperature at the charging door. The increased distance between hearth and charging door and straight lining brings into use the double and triple row of tuyeres. With the better distribution of blast comes more rapid combustion and quicker melting, besides the heated gases are compelled to part with the greater part of their heat before going up the stack. The cupola should be lined straight with double lining from bottom plate to charging door. This makes, after the first heat, the largest inside diameter of the cupola come just above the tuyeres, enabling the charge to move down easily, and avoids bridging. The bottom row of tuyeres should not be more than 14 inches above the sand bottom for any kind of work requiring soft, well mixed iron. Such a cupola properly operated, will be found speedy enough for all castings of such a weight as comes within the capacity of the cupola. A shorter distance would be more desirable if this would allow the holding of enough melted iron in the hearth to correspond with the charges of iron.

Melted iron should not be held in the hearth of the cupola in contact with the fuel, as it absorbs sulphur and carbon, which materially change the character of the iron. It is far better to draw the iron from the cupola rapidly in taps corresponding in weight to those charged into the cupola, and allow the carbon time to change in the ladle or tank. This is the only method I have found which insures the kind of iron calculated beforehand.

To continue speedy melting throughout the heat, the second row of tuyeres should be placed 10 inches above the lower row, and should not exceed one-half the area of the latter. As it is not desirable to produce perfect combustion at this point, it should be a preparatory zone, perfect combustion to take place at the lower row of tuyeres, the real melting zone. The upper tuyeres supply the oxygen necessary for the combustion of the carbon monoxide generated immediately above the lower tuyeres. The melting zone of a cupola is from 8 to 12 inches above the bottom row of tuyeres, depending upon the size of the cupola. While one row of tuyeres will melt perfectly hot iron, two rows of proper proportions will melt much faster. Some use the third row of tuyeres, but these cut up the lining badly, and tend to raise the melting zone, which is objectionable, while others claim they necessitate a deep bed of coke. If the charges are made up in small proportions, the bed does not necessarily stand above the upper row of tuyeres, the surplus fuel from the charges replenishes the bed continuously, so that it will maintain its original height throughout the heat.

The cupola should not have any more iron charged onto the bed than in any other charge if it is desired to obtain uniform melting. The experienced eye can detect whether the cupola is being worked to the best advantage by the appearance of the flames at the charging door. The lining of the cupola at the charging door should not be more than a dark red heat and there should not be a continuous flaming up through the topmost charge, as this indicates an excess of fuel. The coke should not be more than nicely warmed until it reaches within three feet of the melting zone. Deficient blast, or a short cupola will sometimes cause flaming through the top charge. There should be a flame in the stack just above the charging door, which is the burning of carbon monoxide, issuing from the incandescent coke just above the melting zone, and is characterized by a bluish red color. Such an appearance always indicates good melting. A yellow flame streaming through the charge directly up the stack indicates that not enough air is being supplied. If the proportion of air is right, this flame denotes that the furnace is bridged, or bunged up. The tuyere area should be determined by the diameter of the cupola, the blast pressure, and the quality of coke used. The blast should be effective over the whole area of the cupola and if this is large, then a higher pressure of blast is necessary, pressure to range from 11 to 16 oz. The coke must be hard under such conditions. If the coke be soft the blast must have less pressure and more volume, to prevent the abrasive action on the incandescent coke, as using soft coke under higher pressure and hard blowing will result in the melting zone becoming hollow, followed by a bridge of slag and a bunged cupola. The tuyere area at the melting zone should be one-twelfth the area of the cupola, one-twenty-fourth for the upper row, with 1.65 cubic feet of air per minute for each square inch of area at the tuyeres. I have never known this rule to fail in doing good melting if the cupola is properly managed.

Great care should be taken in starting the fire. To ensure good melting, the coke in the bed should be red throughout, yet not burned away. The bed should be 12 inches above the

....Crescent Iron Works....

Daily Foundry Report.

Date .....

...MATERIAL....

HEAT CONSISTED OF		FUEL USED		RESULTS OF DAY	
Pig	lbs	Fresh Coke	lbs	Good Castings	lbs
"	"	Old Coke	"	Bad Castings	"
"	"	Flux	"	Gates, Etc	"
"	"	Wood	Cords	Returns from bottom	"
"	"	Ratio Iron to Fuel	to	Loss	"
Foundry Scrap	"	Blast on No. 1	P. M.	Total	
Railroad Scrap	"	Blast on No. 2	P. M.	R. R. Castings "Frisco"	lbs
Miscellaneous Scrap		Bottom Dropped No. 1	P. M.	R. R. Castings	"
Total		Bottom Dropped No. 2	P. M.	Jobbing Castings	"

...LABOR....

		Laying off		Quit		New Men Started	
Moulders on Floor							
Apprentices on Floor		" "		"		" " "	
Helpers on Floor		" "		"		" " "	
Core Makers		" "		"		" " "	
Cupola Men		" "		"		" " "	
Chippers		" "		"		" " "	
Carpenters		" "		"		" " "	
Yafdmen		" "		"		" " "	

SUPPLIES ISSUED

		FOUNDRY	CORE ROOM
Mould'g Sand	1	cu ft	cu ft
	2	" "	" "
	3	" "	" "
Sharp Sand		" "	" "
Facing		lbs	lbs
Blacking		"	"
Flour		"	"
Nails		"	"
Fire Clay		"	"
Lumber		ft	ft
Fire Brick			

Form No. 27, 12-27-01—2 M. To be compiled daily by Superintendent's office.

FORM OF FOUNDRY REPORT EMPLOYED BY THE CRESCENT IRON WORKS, SPRINGFIELD, MO.

FORM OF FOUNDRY REPORT EMPLOYED BY THE CRESCENT IRON WORKS, SPRINGFIELD, MO.

lower tuyeres and well leveled before charging is commenced. The iron should be snugly packed into the cupola and kept level, as the charges rise, until the cupola is full to the doors. Stop up the tap hole with tempered molding sand which will dry and crumble before the tapping bar very easily, and give a nice clean hole. A sound cupola breast will avoid the use of the sledge, and will ensure a hole of its original size throughout the heat. When the blast is put on, run the hearth full to the tuyeres before tapping. Melting begun, do not let the charges get below the door until the whole amount to be melted has been put in. Limestone should be used as a flux, and the slag hole opened about the tenth tap, with taps and charges corresponding in size. Care should be taken, however, to slack off the blast just as the last charge is being broken through, to protect the lining. Twenty minutes' hard blowing at this time will damage a furnace more than two hours' service with a full cupola.

The foundryman who does not devote any time and study to his cupola from day to day, cannot expect to master it, but, if he will be accurate with weights, and deviate from day to day, always starting on the safe side, he will soon find the cupola his willing slave. It is an unwritten law among cupola men to always throw in just a little more coke to be sure and have a good heat, and day by day this continues until you find your heats dragging over time and your system broken. When a cupola is working just right, ten pounds of coke, extra or short, will be seen at once in the result. The fine points in operating cupolas are many, though they are not always appreciated by the average foundryman. Many hours of worry would be avoided them if they would look more to their cupola, and not be hunting in the sand pile for causes which are to be found in the cupola only. F. W. STICKLE.

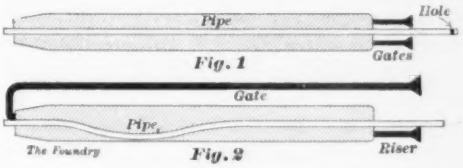
The Phoenix Foundry Co. has been incorporated at Chicago with a capital of $10,000 by A. W. Miller, A. D. Rehm and S. R. Wilson.

The Novelty Mfg. & Plating Co., will establish a foundry and machine shop at Muniseng, Mich. The capital stock of the new company is $25,000.

The Plainfield Foundry Co., has been incorporated at Plainfield, N. J., to manufacture building specialties, by George B. Naylor, C. E. Gulick and John R. Naylor. Capital stock $20,000.

Inserting Gas Pipes in Castings.

Some time ago we had a considerable quantity of hydraulic work to turn out, and among other castings there were several pistons for accumulators, twelve feet long and 10 inches in diameter. As these pistons were to be finished all over, it was necessary that they should be cast vertically. One peculiarity in connection with these castings was the requirement that a one-inch round hole should extend throughout their center, as shown in Fig. 1. The idea of using either a loam or a sand core



INSERTING PIPES IN CASTINGS.

for this purpose was abandoned as impracticable, principally owing to the anticipated difficulty of securing a clear vent through a sand core or removing such a small core barrel as it would be necessary to employ from the casting.

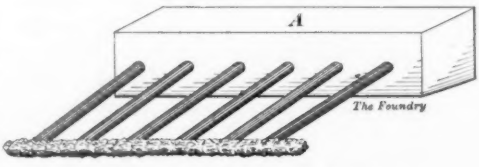
Eventually it was decided that the simplest way out of the problem would be to cast a one-inch gas pipe in the center of the piston. The casting was molded on its side, the gate being placed at the bottom of the casting, as shown in Fig. 2. When the mold was ready to close the pipe was laid in position and fastened inside the flask so that it could not shift when the mold was upended. When the mold was closed the pipe was fastened outside at the bottom so that it could not be forced up into the mold in any way, two inches of the pipe being left protruding from the mold and the top of the pipe was left quite free to allow for expansion. When the casting was put in the lathe it was found that the gas pipe cut right through to the side of the casting, as shown in Fig 2. The question naturally arose as to how this should be accounted for and some consideration had also to be paid toward preventing a similar occurrence in the future. Sometimes a molder finds considerable difficulty in answering questions of this kind, but the conclusion we arrived at was that the casting being run at the bottom there was necessarily a continual flow of hot metal at that point, causing the pipe to get very hot at the bottom end, this permitting the pipe to collapse with its own weight and fall against the side of the mold.

In molding the next casting, the pipe was fastened at the bottom in the same manner as before, but the bottom gate was abandoned as it was thought to be the cause of the mischief in the first instance. Instead two gates were placed on top of the casting, as shown in Fig. 1, the pipe being allowed to extend two inches through the end of the flask, as in the first, only with the difference that a ⅜-inch hole was bored through the end of the pipe, one inch from the top. A flexible wire was inserted in this, the other end of this wire being led over a sheave pulley fastened to the roof and a 120-pound weight tied on the end of the wire. Thus there was a strain of 120 pounds on the top end of the pipe and after the casting had been poured it was found that the distance the pipe protruded through the mold had increased about two and a half inches. The casting being twelve feet long the pipe should have expanded about an inch and a half only but the extra length was no doubt caused by the strain exerted upon the pipe by the weight. When examined the hole was found to be perfectly true and the same method of casting was followed with the balance of the order with satisfactory results. HARRY WILLIS.

Looking Backward.

The foundry of a car works is an excellent place for a boy in which to waste three or four years of his valuable time. For nothing is surer than that if he wishes to master the trade of molding he will certainly have to serve his apprenticeship all over again in some good shop, no matter how many years he has spent in a car works foundry. This has been my experience and I venture the assertion that I did not use a gagger during the whole time I worked in the car foundry. When I look back and recall some of the ludicrous things, which happened there, I cannot repress a smile. On one occasion when business was dull, the firm contracted for some outside work, among which was a casting, resembling a pan in shape, this being about twelve feet in diameter and two feet deep. It was to be made in green sand, the core to be lifted in the cope. The first casting we made, while being poured, raised the cope and when taken out of the sand proved to be two inches in thickness instead of one. More weight was piled on the next mold but the cope was again raised when the casting was poured. About the time the next mold was to be started a fellow happened to come along looking for a job. He saw the second casting just as it was taken from the sand and noticed that it was gated from the top edge, when he suggested that it would be a better method to gate it from the bottom, which was later tried and proved successful.

The first method of gating might possibly have produced as good a casting if some attention had been given to the pouring, and this "cut" at the right moment, but all the time this was considered of no importance. When I think of the stupidity of the molders in this shop, the majority of whom were in the neighborhood of forty or fifty years of age, it almost seems incredible. Another incident worth relating and which showed the lack of intelligence possessed by the foreman in regard to foundry matters in general occurred about this time. One of the molders had some castings to make which were required to finish up clean in the machine shop. In order to produce a clean casting he used what is known as a "Finger Gate," also sometimes called a "Dutch Gate." The general appearance of such a gate when detached from the casting is shown in the accompanying illustration. The square block A is bedded in the cope when this is being rammed up, the top of the block coming even with the top of the cope. Or, in other words, the block forms the runner or pouring basin.



"FINGER" OR "DUTCH" GATE.

This block is pierced by about six holes from ⅝ to ¾ of an inch in diameter through each of which in turn a wood pin of corresponding diameter is punched down to the joint of the flask. After the cope is lifted off, these holes are connected by a channel, branch gates leading from this to the mold. The first morning after this gate had been used the foreman came along and seeing several of them lying around asked the molder, what kind of castings they were. The molder who enjoyed a joke, and had no particular respect for the boss, said he did not know but that he had just received an order for 50. The foreman hurried out of the foundry and presently came back accompanied by the superintendent to whom he showed the "special casting"; the

latter said nothing but seemed in a hurry to get away so that he could indulge in a good laugh without being seen by the workmen.

H. W. BURY.

The Treadwell Ladle Car.

We show with this illustration a foundry ladle car which was designed and built at the Myerstown, Pa., works of M. H. Treadwell & Co., whose chief offices are at 95-97 Liberty St., New York City. This car was designed for the purpose of carrying melted iron throughout a foundry and distributing the same through smaller ladles to the foundry floors.

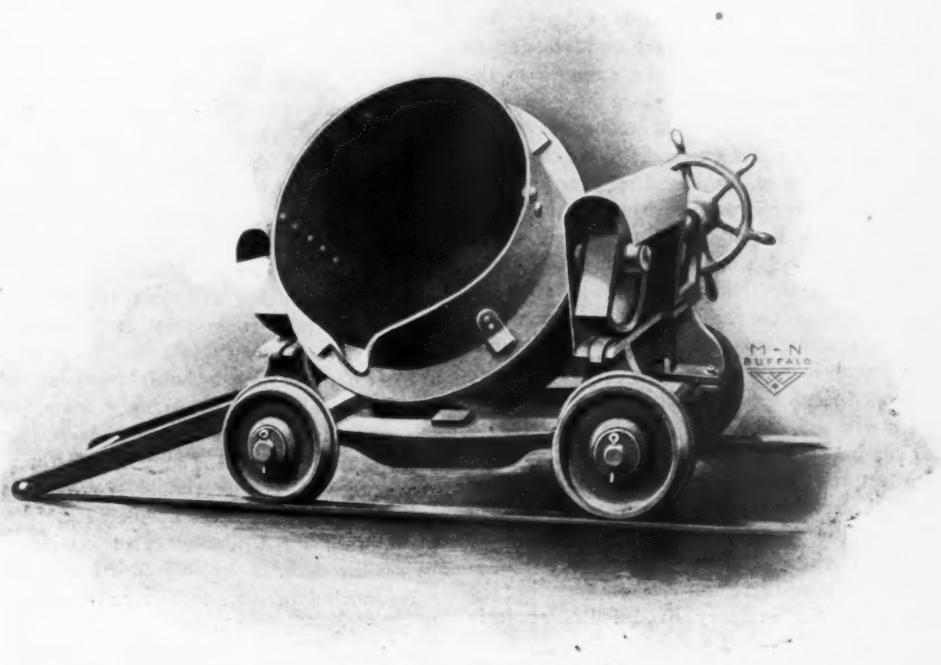
Where a foundry is equipped with an industrial railway throughout its gangways and reaching the cupola, these ladle cars are used economically and give hard and continuous service. The manufacturers claim that in smaller foundries, where there are no cranes to handle the large ladles, such a ladle car is not only more convenient for distributing iron, but that it is also safer than an overhead system of tramways.

The illustration shows a car for a track of 24 inch gauge, the ladle having a capacity of 3,000 pounds of melted iron. The construction is such that the ladle can be turned on its axis, thus dumping the contents on the side of the track, clearing same by 10 inches. This is accomplished by the lateral movement, which the ladle has on the car trucks, supporting it.

The ladle is tipped by means of a hand wheel attached to a special sleeve, the threads of which engage with a screw attached through a trunnion. The ladle in tipping moves over the center line of the track on that side on which it is tipped.

The segmental gears meshing with the racks act as runways for same on both sides. The gear has a self locking device in all positions. The entire car is of steel construction with the exception of chilled cast iron wheels. The wheels are equipped with roller bearings, enabling a loaded car to be handled on the track with ease of propulsion. These cars will be designed to meet special requirements, having any gauge or capacity.

The name of the Hoefinghoff & Laue Foundry Co., Cincinnati, Ohio, has been changed to the Bollman-Wilson Foundry Co.



THE TREADWELL LADLE CAR.

Malleable Cast Iron.

BY H. E. DILLER.

Much has been written of late calling attention to the rapid growth of the malleable casting industry, in which not only new works are springing up in the large iron centres, but older establishments are also expanding very materially. There need be little wonder at this when it is considered that the malleable casting is peculiarly adapted to the requirements of four great classes of work; agricultural implements, railway supplies, carriage and harness castings, and pipe fittings. Were it not for the fact that malleable iron is not adapted to the heavier sections, it would be a sharp competitor to the gray iron casting.

In its manufacture the special make of iron called "malleable Bessemer," or "malleable coke iron," is the principal material used; the charcoal irons, though unequalled, being confined to the regions where they can compete with the cheaper coke irons. The silicon should be .75 to 1.50 per cent phosphorus under .20 per cent, while sulphur should be below .04 per cent if possible. A pig iron, higher in sulphur, in reality an off-Bessemer, while meeting the silicon specifications perfectly, should not be used except in limited quantity, and then carefully watched. With the pig iron, hard sprues (unannealed scrap), steel and also malleable scrap is charged. The latter two materials are very good to add to the mixture as they raise the strength of the casting very considerably. Care must be taken not to add too much, as this reduces the carbon to a point where fluidity and life in the melted metal is sacrificed.

Malleable iron is produced in the cupola, the reverberatory furnace, and the open hearth. The first process, under ordinary conditions, is the cheapest. The iron made is, however, by no means the best. Test bars made of cupola iron seldom run above 40,000 pounds per square inch, while with furnace iron there is no difficulty in getting a few thousand pounds more. The most serious objection to cupola iron is its poor behavior under the bending test, the deflection being very light.

In the reverberatory and in the open hearth furnace the fuel is not in contact with the metal and the result is much more satisfactory. The metal in these furnaces may either be caught in the ordinary hand ladles or it is tapped into a large crane ladle and conveyed to the distributing point and there emptied into hand ladles as required. When tapped into hand ladles, the time taken is a serious item, for the beginning and the end of the heat will show a difference in the metal. The latter iron especially will be inferior, as it is subjected to the oxidizing effects of the flame much longer than the first part. As a rule this difficulty is somewhat remedied by pouring the light work first, the heavier pieces coming later, when the silicon has been lowered too much for light castings. When the contents of a furnace is tapped into a crane ladle, this may be sent to any part of the foundry and the molder has much less space to travel over, and this will doubtless be the coming method.

It takes a good man in the foundry as well as in the pattern shop to handle questions arising in connection with the manufacture of malleable iron. The gating should be so done as to avoid shrinkage effects and other little tricks that can be applied make a surprising difference in the molding loss. As a consequence some malleable works seldom lose more than 10 per cent, while in others 20 per cent and over is the rule.

After the castings have been tumbled they go to the annealing room, where they are packed in mill cinder or iron ore, in cast iron boxes. These are carefully luted up, and heated up in suitably constructed ovens for the space of five or six days. It usually takes 36 to 48 hours to get the oven up to heat, the temperature ranging from 1600 degrees to 1800 degrees F., the boxes having a somewhat lower temperature at the coldest point. When the fire is extinguished, the dampers are closed tight, all air excluded and the oven allowed to cool very gradually, often but 400 degrees F. the first day. After the castings come from the annealing oven they are again tumbled to remove the scale, when they are chipped and ground for shipment.

The hard casting should have its carbon practically all in the combined state, while the annealing process should convert this to the so-called temper, or annealing carbon. A well annealed casting should not have much over .06 to .12 per cent combined carbon remaining in it. Under-annealed castings can be readily detected by their brittleness, but it takes much experience to be sure that a casting is over-annealed. There is a material difference between the strength of an over-annealed casting and a normal one. I took two bars from

*From the *Journal* of the American Foundrymen's Association.

each of five heats. One bar from each set I gave the usual anneal; and the others I re-annealed. The average tensile strength of the first set was 50,520 pounds per square inch, and the average elongation was 6¼ per cent in six inches. The re-annealed set had an average tensile strength of 43,510 pounds per square inch, the average elongation being 6¼ per cent in six inches. Over-annealing had therefore cost the metal some 7,000 pounds of its strength.

The fact that malleable castings are little understood may account for the limited way in which they are specified. While some railroads specify the composition and strength of gray iron castings, they do little in the way of the malleable. One railroad for which I made castings called for 40,000 pounds per square inch, and an elongation of 5 per cent in two inches, for sections ½-inch and under, and 30,000 pounds per square inch with a corresponding elongation of 2½ inches for sections ¾-inch to 1 inch thick.

To show to what degree some foundries are meeting these demands, I took test pieces from some of their castings. The tensile strength and elongation, in six inches, of these pieces was as follows:

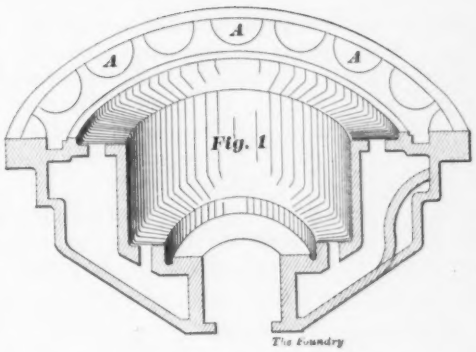
	STRENGTH PER SQ. IN.	ELONGATION.
No. 1.	35,030 pounds	4.7 per cent.
No. 2.	34,410 pounds	3.3 per cent.
No. 3.	37,840 pounds	4.2 per cent.
No. 4.	45,550 pounds	4.0 per cent.

It was also rather odd that the thicker pieces showed the better iron, for usually founders err in the pouring of heavy castings with mixtures intended for light work.

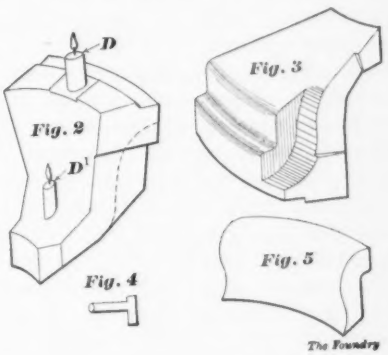
Malleable iron can be made up to 60,000 pounds per square inch, though this is not advisable as the shock-resisting qualities are sacrificed. Yet as specifications become more severe the general quality of this class of castings will be improved until we get a more reliable article, which will better resist the encroachments of the steel casting.

Molding a Cylinder Cover in Dry Sand.

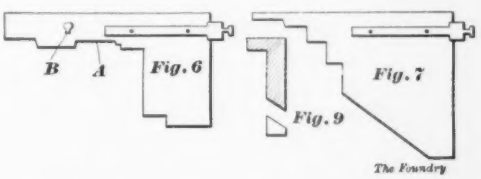
Fig. 1 is a sectional view of a cylinder head for the intermediate cylinder of an H. P. triple expansion engine. Figs. 2, 3, 4 and 5 give an idea of the form of the cores for these castings. Figs. 6 and 7 are sweeps for top and bottom of mold. Fig. 8 shows the cope of the mold with the cores in position and Fig. 9 the gauges used in setting the chaplets, C, Fig. 8.



The casting is molded in the floor, a good coke bed being first put down. After setting the cross and spindle the opening is rammed up to the joint level, a 2-foot pulley ring being used to leave a hole in the center of the mold. The sweep, Fig. 6, is then set and the mold



swept out, A being print for cores of which there are six. To form the bosses shown at A, in Fig. 1, after sweeping out the mold a radius line is struck by thrusting a vent wire through the board at B and sweeping around. Then



with the trammels set to the same radius this is divided into six parts and six lines struck to the center by aid of the gauge, the prints D measured and marked on these lines, those at D, Figs. 2 and 8, being marked by the aid of a plumb bob. A line was also struck between two of these print lines and marked.

The lifting grate E, Fig. 8, is now placed in the mold and rammed up 4 inches with the

ordinary dry sand mixture, when with gauge, Fig. 9, twelve pieces of scrap plate about 2½ inches square are bedded in to take the thrust of chaplets C, Fig. 8. The mold is rammed up to the joint level and the cope rammed up and lifted off. After the core prints are prepared the whole is finished, blackened and dried with pan fires. While drying the cope the bottom part of the mold is dug out and the bottom sweep-board set and the drag part

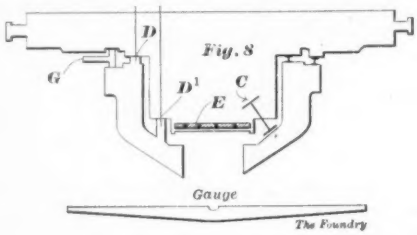


Fig. 8

of the mold rammed up with what is known as black loam, a mixture employed which is composed of two part of yellow sand, one part floor sand, one part in twelve of coal dust, and one to fifteen of horse manure. All of this is milled and tempered like green sand facing and may be struck up almost as well. This mixture possessed the advantage that it does not require a great deal of drying and gives a good, firm face to the mold when wet-blackened and dried. The cores, Fig. 5, of which there are two, are set to form a clearance space for the steam entering the ports. When the mold is blackened a fire bucket is hung therein and the whole covered with sheet iron. While this is drying the cope is turned over and the main cores set as shown. These cores are built up on loose irons, the latter continuing through the vent cores to form a staple as shown.

H. SAYERS.

Skin Dried Molds.

There are many castings at the present time being made in skin dried molds, which were formerly made in dry sand exclusively. A fire bucket and a little coke is not a great item of expense and the use of this will many times prevent many hours' work in chipping off scabs, and will also save much time in the cleaning of castings. There is also much greater certainty of receiving a perfect casting if a mold is skin dried than there is if the same is cast in green sand.

Some years ago when working in a marine shop an incident occurred which demonstrated the saving which can be effected by the judicious use of a little fire. A couple of molders were busy making a condenser end cover in green sand and quite a number of these castings were wanted. They were 5 feet long, 2 feet 6 inches wide and about 3 inches deep in the center, the dished part being formed by a sweep. One of these molds was cast each day and I noticed that nearly every casting had a few ugly looking scabs on the top face near the running gates. The men who made the casting did not seem much surprised at this, as they said that these castings were nearly always scabbed more or less and that they had tried nearly everything in the way of venting and nailing the places where the scabs occurred, and had used different kinds of facing sand and rammed the mold at different degrees of hardness, but whenever they thought they had found the remedy, through having obtained a casting with less than the usual number of scabs, the next one would come out as bad as ever. The foreman had a regular habit of coming around and swearing at the men working on this job, and also calling them some very hard names, to which they had become so accustomed that they took this as a part of the daily routine of the shop. Putting all I knew into the work allotted to me, and as my castings were coming out first-class, I was beginning to hanker for a better class of work, when one day the foreman brought in a condenser cover pattern, similar to the one being made by my shop mates next to me, saying, "See if you can make as nicely scabbed castings from this pattern as those fellows there." The men heard this and grinned, anticipating that they would have the satisfaction of hearing me receive my share of abuse in due time. A helper was sent to me and we proceeded to bed the pattern in the floor, sweeping out the dished center. Just as we were lifting off the cope the foreman came around and ordered it removed to another part of the shop and turned up against a wall some distance away near the loam end of the foundry. Having finished the cope part as nicely as I knew how and hoping that it would not scab but expecting that it would all the same, I went to finish the drag part of the mold. This was just before quitting for dinner, and when returning an hour or so afterward I growled considerable, for some of the loam hands had been using fires and having occasion to remove one from a mold they had placed it in the immediate vicinity of my cope, the result being that all around the gate end, the mold was very dry, and to make matters worse the dried part had received a knock in some way, making a big dent, so I had to set

to and dampen this and fix it up with fresh facing sand, afterwards nailing it between the gaggers. However, I finished it off nicely and applied some black wash with a swab from a bucket, which happened to be near by, and then replaced the fire where I had found it.

In due course the casting was poured and the next morning I was anxiously looking for that which I did not want to find, namely scabs, and I am pleased to say I did not find any, the casting being perfectly free from defects.

The foreman noticing this was very complimentary to me and more abusive than ever to the fellows near by, but I felt that this was only temporary and that my turn would come next, for I could not reason out why, with the same tackle, facing sand, and other conditions of molding the two covers identical, one casting should scab and another should not, especially so since the molders who were having the bad luck were considered pretty good men and made most any casting that came along without trouble. All at once the idea struck me that the accidental drying of my cope the day before had been the means of my turning out a perfect casting, and that following the same course all scabbing could be stopped. Therefore, in making the next mold I used a facing which would stand a little fire and when I had the mold finished I took care to place a fire where it would do the most good. Following this course I was not bothered with scabs on any of the castings I made later and it was not long before the foreman thought I had better look after all the covers which were being made, which in more ways than one meant promotion for me. No one can blame me if I kept the reason of my success to myself as no one guessed that an accident had been the means of doing these castings and myself such a good service. GEORGE BUCHANAN.

John L. Faulhaber has sold his foundry and machine shop at Fostoria, O., to parties who will incorporate under the name of the Fostoria Foundry & Machine Co. Additions which will double the capacity of the plant will be built and a large amount of new machinery will be installed. The new company is composed of O. C. Ringle, J. A. Ohlinger, Walter Wainwright, Frank Jones, Elmer E. Lyons and C. H. Olds. Mr. Wainwright who was formerly superintendent of the Massillon Iron & Steel Co., will have charge of the Fostoria plant.

Casting Temperatures.

The proper temperature at which the various brass founders' alloys, or any metal, should be cast, is a subject which deserves investigation. The best heat for good results is largely a matter of conjecture, and, in the foundry at least, altogether a question of practice. Heats in the sense of casting temperatures are only comparative in the foundry. Thus, yellow brass might justly be said to be very hot, while gun metal *at the same temperature* would be dull and probably unfit for making castings. Good judgment is required in deciding the most suitable temperature for casting alloys, as one is easily deceived. For example, one heat may be cast in bright daylight and appear normal as to temperature, while another heat cast *at the same temperature* in the dark would be considered "jumping hot."

Many writers on alloys speak of the "proper heat" for casting, but no authority has yet ventured to fix the proper degree of heat for casting any of the alloys, and even if such a thing were done, there is the insuperable difficulty of the want of appliances for correctly determining the heat of metals in the foundry. The invention of a foundry pyrometer for testing the heat of metals *outside of the furnace,* is still to come, and if once the other matter of "proper heats" was fixed there is no doubt the proper instrument for testing the same would soon make its appearance. This is really a matter for the attention of some such body as "The Alloys Research Committee," and one which it would be of untold benefit for the foundryman to have some definite pronouncement upon. The brass founder uses a few terms and rules which, as we have already said, are only comparative. For instance, he may express himself thus: "Yellow brass cannot be cast too hot; phosphor bronze cannot be cast too dull; gun metal should be cast at a *nice* heat, and antifriction metals should never be allowed to come to a red-heat."

That is the whole foundry practice, with regard to these metals, in a single sentence. To say more on that score would be to enlarge without enlightening the subject. But for the purpose of emphasizing the vast amount of uncertainty which surrounds this question of the proper heat for casting alloys, we might add that we have seen one man judge the temperature by the heat imparted to the skimmer in a given time; if the skimmer showed signs of melting soon, then, if it was gun metal or phosphor bronze, the metal was too hot. Another

man would judge the heat of the metal by the rate at which it was able to dissolve a "cooler," and yet another would depend on reflected light, and shut a window or a door for the purpose of seeing the metal in a dimmer atmosphere. These are some of the ordinary methods of judging casting temperatures, but there are other and more arbitrary rules for some of the special alloys. Thus it is said the proper time to cast phosphor bronze is when it begins to *break;* for arsenic bronze, when the *bead* rises in the centre, and for babbitt metal when a dry piece of stick does not smoke when inserted.

It is well known that phosphorus and aluminum both act as reducing agents in combination with other metals, and they are specially active in lowering the fusing point of metals. The foundryman takes advantage of this fact to improve the fluidity or homogeneity of metals, so that he can run fine work or be assured of solid castings with indifferently fluid metal. He imagines he is "fluxing" his metal by so doing, and in the ordinary sense of the word, where to flux is to make to flow, he may be right, but in a metallurgical sense there is an important distinction between a flux and a reducing agent.

Fluxes attack or combine with the infusible or, the insoluble matter generally found on the surface of molten metals; reducing agents combine with the metals themselves or their oxides, i. e., fluxes yield slags; reducing agents yield *metallic* compounds. The action of reducing agents is the separation of the oxygen or sulphur from the metal with which it is combined and owing to this they are sometimes called deoxidising or desulphurizing agents, whereas, most of the so-called fluxes are simply used as protective coverings on the surface of the metal to prevent oxidization.

Fluxes are useful to the founder only in so far as they have a refining influence on the metals he is using. Some founders pin their faith to one class of flux for refining purposes and use quite a different article for regulating the properties of the metal. This is as it should be. Many of the modern fluxes are supposed to have the additional virtue of imparting new properties to metals and often they are reckoned to allow great latitude in casting temperatures, but where this occurs, you may generally rest assured that some metallic or semi-metallic substance has been the means employed. Chemical affinity applies to all elements in solution, and chemical reaction applies to such elements as possess affinity for each other in forming new compounds. By chemical reaction heat is generally evolved, besides which, the mean temperature of two metals in combination is very frequently reduced. But in dealing with metals for making castings it is always better to give them the proper heat treatment, than to depend on any purely chemical action or addition as a means of securing fluidity, or homogenousness or any other desirable quality. The properties of a metal can be very well regulated by alloying, the temperature at which a metal is cast may have something to do with its ultimate properties, but this can best be controlled *while it is in the furnace*—not after it is taken out. There is an axiom in some foundries, to the effect that metal is better cast too hot (sic) than too cold, but the truth of this is not always apparent. We believe that there is a proper casting temperature for all metals or alloys and the consensus of practical opinion favors this idea, but until some steps are taken to establish the principle of "proper heats," we must content ourselves with the knowledge that practical experience gives us and go on casting things at *a nice heat,* or as near to the "proper heat" as the frailty bred of foundry fuss and fallacies will permit. J. F. BUCHANAN.

The Use of Aluminum for Patterns.

Every molder likes to have a pattern as light as possible, whether this be mounted on a matchplate or gated in the ordinary fashion. Lightness facilitates fast work and aluminum offers the lightest material for metal patterns. Lack of familiarity with the peculiarities of this metal on the part of the founder has prevented its adoption for patterns to the extent which it deserves. Harland Tuttle in a recent issue of the *Aluminum World* gives the following advice on this subject, which is of general interest.

For several reasons aluminum is exceptionally good for metal patterns. On account of its lightness, which is, of course, its chief advantage, much larger patterns can be carded than is possible with the soft metal alloys. For instance, the specific gravity of aluminum is 2.5 while that of the tin-zinc and the tin-antimony alloys is about 7, while the zinc-lead alloy is about 9. It will thus be seen that with the same size gates patterns of aluminum can be carded of three times the volume of the soft alloy patterns with the same liability of breakage. The writer has the care of some three hundred cards, about two-thirds of which

are aluminum. There are by actual count between thirty and forty broken joints of the soft metal cards brought in to be soldered to one of the aluminum. The cost of carrying cards to and from the foundry and the repairing of them amounts to quite an item in a year, most of which is saved by the use of aluminum cards.

Another advantage, due to its lightness, is that with fairly large patterns more can be placed on a card, while often patterns which would be too large to card in the heavy alloys can be carded to advantage in aluminum. The necessary amount of rapping to loosen the patterns in the sand is also much less, thereby lengthening the life of the card, while the molders like them much better because of the greater stiffness and ease of handling. The metal is also especially adapted to light, flimsy patterns, as it will not bend out of shape from dropping or by conforming to the shape of a worn out follow-board, as soft alloy patterns do.

In regard to the first cost, aluminum makes a very cheap pattern metal on account of its bulk, aluminum at 30 cents making patterns cost about the same as a tin-antimony alloy at 12 cents. The metal files easily and finishes well upon a sandpaper wheel or drum.

It is often said that aluminum must be melted in a black lead crucible rather than in an iron ladle, as the metal has a great affinity for iron, and over a coke fire, but this is not necessary for pattern work, a common iron ladle being just as good and more convenient, while blacksmith's coal with a blast in a small forge will easily melt it.

More or less oxidized metal and dirt will collect upon the surface of the melted metal, but this need not be skimmed off each time, but merely pushed back from the mouth of the ladle at each pouring. This dross will help keep the metal from further oxidization. Of course, it will eventually collect in such quantity that it will be necessary to skim.

In making aluminum castings the sand should be kept as dry as will mold well, as a little overdampness will cause aluminum to blow where a heavier metal would remain full. For instance, iron, being three times as heavy as aluminum, three times as much power would naturally be required to make a blowhole in it as in aluminum.

Aluminum should always be poured as cold as possible and still run full. In this way most of the shrinkage is made in the ladle, rather than in the casting. The gate and sprue should both be large, so that the metal will feed into the mold while cooling. This will cause the shrinkage to be formed in the top of the sprue instead of in the casting.

Generally speaking, where the casting is not to be of uniform thickness throughout it should be gated into the heaviest part. However, in the case of thin uniform castings a large gate and sprue should not be used, as the sprue is liable to draw from the casting. In such cases the gate should be a little less than the thickness of the casting.

Top gates should be used much more frequently in aluminum casting than in casting heavier metals. The molds fill better, thus allowing the pouring of colder metal, while they very rarely wash, as in the case of heavy metals. When patterns for pulleys, sprockets, etc., are to be cast the sprue should be set upon the cope center core print, swelling the sprue out top-shaped, so as to give sufficient metal to feed into the hub.

The molds should be rammed soft, and also well vented where there is danger of the mold not filling. All "chunky" patterns should be cored out, using a common dry sand core, leaving a shell of uniform thickness, except where the sheet brass gate is cast in, at which place a spot is filed out of the core to leave stock for holding the gate. Aluminum "nails" can be used for chaplets, which can be made by running a vent wire from the top of a mold up through the cope. This will make small spines upon the casting, which can be broken off and used for the above purpose. The holes left by cores can be either soldered or plugged with wood.

In finishing aluminum patterns, files, scrapers, emery cloth and sandpaper can be used, but if there be any quantity to finish it will be well to have a few sandpaper wheels. The simplest of these is merely a wooden disk, from six to ten inches in diameter, to be run at a high speed in a wood-turning lathe. A sheet of sandpaper is tacked on the face of this disk with cigar-box nails, using six or eight nails. The disk is then turned over, face down upon a board, and a pointed tool scratched around the edge, to cut the paper true with the disk. This wheel is easily renewed by tacking on another sheet of paper.

A machine which will do much more rough work can be made in the shape of a cylinder two feet long and twelve or fifteen inches in diameter. This will take the standard width "Garnet" sandpaper. No. 1 is right for finishing and No. 2 for roughing. This cylinder

must be run at a comparatively low speed, as it is out of balance and will throw if speeded too high. The joint for the sandpaper in this drum is made by planing a half-round groove in the face of the drum, parallel with its axis and deep enough to let in the two thicknesses of paper and a piece of half-round iron, which is drilled every five or six inches for screws, to be driven into the drum to hold on the paper. This is what throws the drum out of balance.

It will be found upon trial that the paper cuts through very quickly where the casting strikes after jumping over this gap. The paper should be protected here from this wear which can be done by letting a strip of thin zinc under the half-round iron wide enough to lap by the gap about an inch. This "lap" should be "snipped" every inch or so, to prevent buckling when it is pened by the striking of the castings against it.

Aluminum is being tried in many pattern shops throughout the country, and is proving very satisfactory, the only objection being the inconvenience with which it is soldered, which objection is very small in comparison to its many advantages. I have just finished a "batch" of one hundred and twenty patterns in aluminum, only one of which required any soldering and that one but five minutes, being a slight "blow" caused by a lump of wet sand.

In regard to corrosion of aluminum, I would say that we have had patterns in continual use for six years, which is the length of time we have used aluminum, and these patterns are in as good condition as the new ones, except more discolored. The patterns grow smoother with use.

The Ironton Engine Co., Ironton, O., have applied for a charter. The capital stock is $200,000, and D. H. Palmer and J. H. Allfree of Indianapolis, H. A. Martin and A. H. Mittendorf of Ironton are the principal incorporators. The company will manufacture engines, erecting a large plant at Ironton and abandoning one at Indianapolis.

A foundry 55 x150 feet is being built by the Diamond Iron Works of Minneapolis, Minn.

The business of S. C. Van Buren's Son & Co., Carey, Ohio, will be merged into that of Heck & Marvin, Findlay, Ohio.

The Ottumwa Box Car Loader Co., Ottumwa, Iowa, expects to build a foundry in the spring, 90x170 feet, in connection with present machine shop plant.

Deaths.

Simpson Bolland, the well known foundry foreman and writer of foundry literature, was killed by a railroad engine at Ossining, N. Y., Dec. 10. He was born in Manchester, England, July 22, 1838, and began work at the trade at the early age of 12. That he showed extraordinary aptitude may be judged from the fact that when but 22 years old he became foreman of Martin & Sweethurst's foundry at Guide Bridge. For the next ten years he had charge of different shops when he removed to America. Here his ability as a workman was soon recognized and he became connected with several Eastern foundries in the capacity of foreman. He retired from active business about ten years ago to finish the three books he then had under way. The last three years of his life he spent with his son Jas. Bolland, who is foreman of the Rand Drill Co.'s foundry at Ossining, N. Y.

SIMPSON BOLLAND.

George W. Van Tine, general superintendent of the Singer Manufacturing Co.'s foundry department at Elizabethport, N. J., was found dead in his bed on December 12. Mr. Van Tine was sixty-six years old,

and had been with the company about twenty-five years. He was the inventor of the Van Tine molding machine.

Horace Humphrey, founder of the Humphrey iron works, and one of the pioneer residents of Joliet, Ill., died recently. Mr. Humphrey came to Joliet in 1854 and for several years was in the employ of Jones & Cagwin and J. B. Baily. He began business for himself on the present site of the Humphrey Foundry and Iron Works in 1860, under the name of H. Humphrey. In 1882 the two sons, Harry and Fred, were taken into the partnership and the firm name became H. Humphrey & Sons.

George W. Prescott, one of the founders and the first president of the Union Iron Works, of San Francisco, was found dead in his apartment at the Palace Hotel, San Francisco, December 12. He was a native of Maine and was sixty-five years old.

D. O. Richards, president of the Fair Foundry Co., Knoxville, Tenn., died recently at his home in that city.

William S. Jenks, president of the Jenks Shipbuilding So. and one of Port Huron's oldest residents, died December 12 in the company's office at Port Huron, Mich. Mr. Jenks was 84 years of age.

William T. Black, a retired stove manufacturer, formerly a member of the old firm of Black & Germer, died at Erie, Pa., on December 12, aged 73 years.

Joseph H. Johnson, who, for the greater part of his life, was engaged in the foundry business at Paducah, Ky., died on December 8, at his home in that city, aged 73 years. He was born in Pittsburg, Pa., and went to Paducah when a young man.

James J. Lonergan president of the City Foundry Co., Cleveland, Ohio, died Dec. 26.

James M. Pyott, founder of the firm of Holmes, Pyott & Co., Chicago, died Jan. 5th. He was born in Dundee, Scotland, in 1821.

Matthew C. Reddin of the Reddin Iron Works, Syracuse, N. Y. died Dec. 17. Mr. Reddin was 44 years of age and had been identified with the foundry business nearly all his life. He came to Syracuse eighteen years ago and accepted a position as foreman in the foundry department of E. C. Stearns & Co.'s plant, but later became a member of the firm of Brown, Laycock & Reddin, which started the Economy Foundry. After five years Mr. Reddin severed his connections with this firm and established the Reddin Iron Works in 1895.

David L. Evans, a well known foundryman of Pittsburg, died, Jan. 8. He was born in Wales in 1833 and came to this country with his parents when six years of age. Having served his apprenticeship at molding he moved to Ironton, O., where he remained but a short time, coming to Pittsburg in 1854. He became foreman of Anderson's foundry and was later connected with the Rosedale Foundry Co. as employe and member of the firm for 30 years. At the time of his death he was associated with the Pennsylvania Casting & Machine Co. of Allegheny.

Among the Foundries.

The United States Foundry Co. has been organized at Buffalo, N. Y. to do a general foundry business. Edward Farrell is president of the new concern. John F Patterson, secretary and J. F. Morlock, treasurer and general manager.

The Queen City Foundry Co., Denver, Colorado is erecting a new foundry 125x200 feet, which will be equipped with modern appliances for turning out general castings.

The Stroudsburg Engine Works of Stroudsburg, Pa., expect to begin operations early in the year. A machine shop 52x100 feet and a foundry 40x60 feet are nearing completion.

The Colorado Foundry Co. was recently incorporated at Pueblo, Colo. to manufacture malleable and gray iron castings. William Whitington will have charge of the foundry as foreman.

The Oswald Iron Works, New Orleans, La. will hereafter be known as the Southern Marine Works, capitalized at $50,000; Charles G. Coyle, president.

The Columbia Machine Works & Malleable Iron Co. of Brooklyn, N. Y. have placed their foundry in operation. This is presided over by Dick Scull.

The Mount Royal Foundry Co. is a new concern entering the foundry business at Montreal, P. Q. Its capital stock is $45,000.

The Norwalk Steel & Iron Co., which is completing a large steel plant at Norwalk, Ohio, is back of a project to establish a steel castings plant in that city. Plans are under consideration for a main building from 200 to 300 feet long and from 60 to 100 feet wide, together with necessary auxiliary

buildings. A site of sufficient size to accommodate large additions has been secured, and it is announced that the plant will be erected during the coming summer.

The Colorado Fuel & Iron Co., Pueblo, Colo. is operating its new foundry 120x350 feet, which among other equipment contains five electric traveling cranes, four electric jib cranes, two air furnaces of 15 and 18-ton capacity, three cupolas and ten ovens. James L. Steward is general superintendent of the iron, brass and steel foundries and Thomas Whitington foreman.

Another consolidation, indirectly affecting the foundry trade, is the one proposed by the manufacturers of grain drills. The companies which, it is reported, will enter the combine are: The Superior Drill Co. and the P. P. Mast Co., of Springfield, Ohio; the Hoosier Drill Co., of Richmond, Ind.; the Empire Drill Co., of Shortsville, N. Y.; Brennan & Co., of Louisville, Ky.; the Dowagiac Mfg. Co., of Dowagiac, Mich., and the Bickford & Huffman Co., of Macedon, N. Y.

Roberts, Tatem & Co., recently organized, have leased the Thomas Iron Works, Berkley, Va., and after a number of improvements are made to the plant they will be prepared to turn out first-class work.

A foundry will be erected at Eulaton, Ala. by the Eulaton Foundry Co.

The National Malleable Iron & Steel Perfection Coupler Co. is fitting up a plant at Spring City, Pa.

The Reed Foundry Co. have been incorporated at Worchester, Mass. with a capital stock of $75,000. F. E. Reed of the F. E. Reed Co. is president, and John F. Kyes treasurer, and these officers and Eben F. Thompson constitute the Board of Directors. The company will operate a new foundry, which is about ready to begin business.

The Wm. Buck Stove Co. of Brantford, Ont., will erect a new foundry early in the year to be 160x275 feet, and a pattern vault 40x125 feet.

The Mansfield Engineering Co., Mansfield, Ohio, has broken ground for a foundry. It will be of brick and steel construction, 75x175 feet, and will be covered by a 25-ton electric traveling crane. The foundry will be ready for operations about April 1st and is intended principally to supply the company's wants in the way of castings.

The Twentieth Century Heating & Ventilating Co., Akron, Ohio, is doubling the capacity of its foundry.

The Johnston & Jennings Co. of Chicago has moved into their new plant, which is one of the best equipped shops in the country. The same company has also recently occupied its new foundry at Cleveland, Ohio. Sash weights will be manufactured at both points, the plant at Chicago having a daily capacity of 40 tons, while the Cleveland works can turn out 50 tons daily.

The new owners of the Fairhaven Foundry & Machine Works, Fairhaven, Wash., will change the name to the Bay City Iron Works. John T. Graham has been elected manager.

C. N. Welch, proprietor of the Milford Iron Foundry, Milford, Mass., his son, and Edward Bailey, formerly of Easton, Pa., have formed a stock company with a capital of $30,000, and the plant will hereafter be operated by the corporation. The business is to be extended and the plant enlarged by an addition, 50x120 feet.

The Empire Plow Co., Cleveland, has purchased the plant of the Austin-Bryan Mfg. Co., at Ensley, Ala., and will operate it in connection with the Cleveland works. The Ensley plant is a modern one, but will be overhauled and new machinery installed.

The Lawrence Brass Works has been incorporated at Buffalo, N. Y.

Extensions are planned for the Granite City, Ill., plant of the American Steel Foundries, which will make this the largest works of that corporation.

Kerr & Combes have purchased the Copp Bros. foundry at Hamilton, Ont.

Love Bros. of Aurora, Ill., have incorporated with a capital of $200,000.

W. J. Copp and Harold E. Copp, under the style of W. J. Copp, Son & Co., are starting a stove works at Fort William, Ontario, Canada. The company are erecting a large building for the manufacture of stoves and stove furnishings, especially adapted to the Western trade.

Architects Pollmar & Ropes are preparing plans for a brass foundry for the Roe Stephens Mfg Co., of Detroit, Mich.. It will be 40x124 feet in size, of heavy mill construction and will have a trussed roof. The same architects are also preparing plans for an iron foundry for the same company, also to be of mill construction, 68x125

feet in size and 30 feet high. It will be equipped with modern appliances throughout.

The Tucson Iron Works & Mfg. Co. have been organized with a capital of $250,000 to manufacture and deal in machinery at Tucson, Ariz. The incorporators are; B. L. Worthen, H. H. Pilling, S. W. Purcell, J. M. Ormsby and W. W. Robinson.

J. P. Bowie will build a store foundry at Rome, Ga., and manufacture the same line of goods as the firm of Bowie & Terhune, whose plant was recently destroyed by fire.

Richard Turner and Zine Beecher of Marysville, Ohio, will erect a foundry which will be operated by a company to be incorporated, with a capital stock of $25,000. Gas engines, farm rollers and minor implements will be manufactured.

A new company, known as the Maxon-Miller Jack Co., will erect a foundry and machine shop at Huntington, W. Va., for the production of the Maxon jacks.

Rheinhardt Scheidler is building a new foundry at Newark, Ohio.

An addition will be erected to the brass foundry of F. E. Newell, Central Falls, R. I.

The Columbia Foundry Co. has been incorporated at Cincinnati, Ohio, with a capital of $25,000, by A. G. Olberding, Thomas P. Leaman, P. Harrison Guthrie, John F. Helberger and Robert M. Burton.

A general foundry and machine shop is to be built at Ashland, Ky., by the E. M. Roberts Co.

The Eagle Iron Works Co., Terre Haute, Ind., has been incorporated with a capital of $30,000, succeeding the Eagle Iron Works, owned by J. A. Parker and son, George W.

The Toledo Plow Co., Toledo, O., will double the capacity of its present foundry.

The Hannibal Stove Foundry Co., Hannibal, Mo., propose to erect a new factory building early in the year.

The stove foundry of Wm. Mackey & Sons at South Haven, Mich., is being removed to Everett, Wash.

The Washington Iron Works Co., of Seattle, Wash., will extend its foundry.

The Diamond State Steel Co., of Wilmington, Del., will erect a new foundry.

The Braddock Mach. & Mfg. Co., of Braddock, Pa., will increase its capital to $400,000 to provide for future extensions.

Hudson & Sharp, of Green Bay, Wis., have discontinued the operation of their foundry.

Announcement is made of the incorporation of the W. W. Sly Mfg. Co., Cleveland, O., with a capital stock of $250,000 by W. W. Sly, W. C. Sly and L. Smith. The manufacture of improved foundry machinery, designed by Mr. W. W. Sly, will be carried on on an enlarged scale. The latest catalogue of this concern shows, among other equipment, steel exhaust tumbling mills, many of which are designed to meet special conditions, dust arresters, water polishing mills, rosin grinding mills, cinder mills for recovering waste iron, and a mill of somewhat similar construction for use in brass foundries. The Sly "incorporator" for mixing sand, loam or any other material is also illustrated. It is the purpose of the W. W. Sly Mfg. Co. to engage in the foundry business in the near future.

The Youngstown Steel Casting Co., Youngstown, O., has increased its capital stock from $100,000 to $200,000. It is stated that extensions and improvements will be made.

The Manitoba Iron Works, Winnipeg, Man., have been incorporated with a capital of $150,000, by T. R. Deacon, J. A. Coulter, J. H. Johnson and Robert Murray. The new concern will take over the business of the Standard Machine Works, and a new foundry will be built. It is the intention to manufacture engines, boilers, pumps, elevator and agricultural machinery.

How to Prevent "Rat Tails."

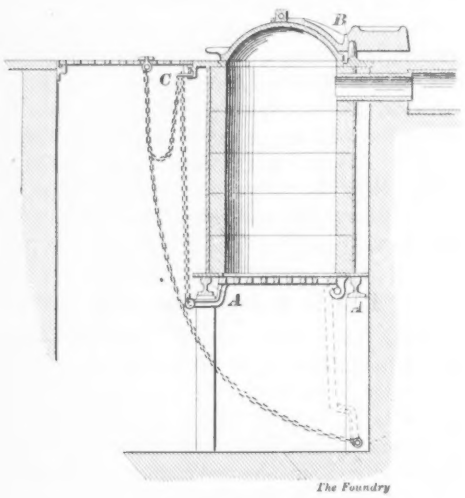
There have been various opinions entertained by molders as to the causes and how to stop what is known to the stove plate molder as "rat tails," in other words, streaks which appear most in tops or covers, resulting in great loss to both the molder and manufacturer, says a writer in the *Iron Molders' Journal* who offers the following remedy: I have worked on cook stove tops for a number of years and given the "rat tail" evil much thought and have tried all kinds of experiments. I never could find out the cause of this defect in a casting; however, I did find how to stop it.

When making work that is returned, use cement between the heavy and light facings, first, heavy facing; second, cement; third, light facing. When making work on which no facing is used, take one shovelful of slaked lime to sixteen shovelfuls of sand, mix well and run through a fine riddle; use just enough of this to cover the face of the plates. If this should

not stop it use a little more lime, say, one shovelful to fourteen of sand. Any molder who will give this a trial will find it a sure remedy.

A New Brass Furnace Design.

A patent has recently been granted A. I. & E. H. Weatherhead, of the Cleveland Faucet Co., Cleveland, O., covering the brass furnace shown in the accompanying illustration. The main body of the furnace rests upon two parallel beams A, supported by columns rising from the base of the ash-pit. The top of the furnace as well as the grate in front of same comes level with the floor. The shell of the furnace is of ordinary construction as is the plate forming the top of the furnace, with the exception that the part which forms the seat for the furnace cover is made separate and may thus be easily renewed if it should warp or otherwise become out of shape. The cover is dome shaped and fastened to it is a balance weight, provided with an opening for the pin B, upon which the cover nearly balances and may



A NEW BRASS FURNACE DESIGN.

easily be moved to either side, whenever it is desired to have the furnace open, without requiring heavy lifting. The chief feature of this furnace is the ease with which the grate may be manipulated from the floor, without requiring the furnaceman's presence below. The grate is hinged at the back and a chain attached to the front by which it may be secured to the hook C. When it is desired to drop the grate the chain is unfastened when the grate falls back to the position shown by dotted lines.

Fires.

The foundry of Hartford Woven Wire Mattress Co., Hartford, Conn., was damaged to the extent of $5,000 by a recent fire.

The plant of the Wiles Mfg. Co., Fultonville, N. Y., was totally destroyed by fire Jan. 8. It is reported that manufacturing operations will be transferred to another locality.

The Rock Island Iron Works, Morris & Lewis, proprietors, Rock Island, Ill., burned Dec. 30.

A fire at the Vaughn Machine Works, Peabody, Mass., Dec. 26, damaged that plant to the extent of $50,000.

A fire in the foundry of the Miller Iron Co., Providence, R. I., caused a loss of about $10,000 Dec. 12.

Defective Castings.

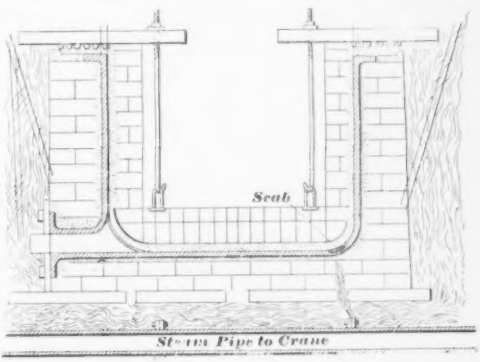
Probably we have all seen too many bad castings and yet know too little of them. I am sure every foundryman will be able to recall times in his experience when he wished he had been a baker so that he could eat what he spoiled. In the present instance, the writer proposes to tell of one of the bad castings he made in the hope that the information will help someone puzzling their brain to find the cause of defective work under similar circumstances.

A few years ago, while employed as a loam molder in one of the best machine tool foundries in Scotland, the writer was working on some large pans for Nobles, Ltd., of explosive fame. The first ten were cast perfect without a flaw, but the next one had a large scab about the size of a man's hand at the fillet on the bottom of the core, about where shown in the sketch. When the casting was taken out of the hole the casting cleaners called the foreman's attention thereto and he at once sent for me. He was a brusque, gruff but good hearted fellow and his first query was "See that scab?" I replied that I did. "Know what is the cause?" was the next question. "No, I don't," I said. "Well, find out before you close your next mold," was his final shot and off he went. I puzzled over the cause of that scab, it haunted me by day and I dreamt about it by night. It was discussed by the molders during meal hours and half a dozen different reasons were given for its existence but none of them were satisfactory to me. One fellow, a green sand molder, said that the bricks ought all to be dipped in clay water before being used and

a vent wire run in between the joint of bricks all around the place where the fillet was. I did not answer him nor argue with him. Another fellow suggested that one of the gates was playing on the top edge of the fillet and had started the loam. Another said that I had used a hard brick at that spot and the air not getting away from the face of the brick had thrown out the loam. One advanced the opinion that the core had not been properly dried, another that the apprentice had upset the swab pot on the top plate after the job was closed and the water had run down the gate nearest the scab.

All of these suggestions tended to weary me as I knew that this particular mold had received the exact treatment of others previously made. All I did know was that the last mold had made a scabby casting while the others had been perfect. When I was ready to close the next mold I called the foreman over and told him that I had not found out the cause of the scab on the previous casting. "Huh!" said he, "Go on and get this one closed and we will see what it looks like." The mold was closed, cast and when the casting was lifted out there was that same scab again, similar in every respect and in the exact place of the one cast before. This made things interesting. "Pull out those bricks where the scab is and get into your ashes in the buildings, you can't have your vent connected there," said the foreman. I protested that the building was the same as had been used in casting the ten perfect ones. (I should have stated that we always saved the brickwork of these molds.) "Never mind, pull it down," and down it came. The next casting had a scab exactly as before, the same size and in the same place. I felt a bit ashamed and did not speak much for a day or two until the next mold was cast, and behold, there was that same thing again.

Every man in the place had a chance to examine these castings but no one advanced any theory for this particular defect which helped me in the least. I trembled for my job. However there was just one more casting to be made and I would try again. I watched everything around that spot very carefully without noticing anything at all suspicious. I let the foreman have a look at the mold before it was closed and it seemed all right. He had no fault to find, yet, when the casting came out, the scab was there as ugly as ever. To say that I felt bad was to put it mildly. Some said "Hard lines," others "Oh! just a run of bad luck you are having," but I knew that no matter what was the cause, bad luck had nothing whatever to do with it. There must be a reason, and a pretty good reason, too, to make itself known on five castings in succession. The order having been completed, the brick work was taken down and I carefully examined the bricks that came from anywhere near the location of the scab. I observed that some of the bricks were moist and as the casting had only been a few hours out of the hole, they should not have been in this condition. It was not, however, until the bottom plate was lifted out that the cause of the moisture on the bricks was ascertained. The joint of a steam pipe came directly under a hole in the plate and this joint seemed to have given way when the tenth pan was cast. The moisture did not show on the face of the mold when this was closed, as the drying of the mold had made everything so hot that the heat absorbed the steam for a short distance and this allowed us to get the mold closed without noticing anything wrong. The



THE CAUSE OF A DEFECTIVE CASTING.

time elapsing between closing the mold and pouring it allowed a sufficient period for the steam to get through to the face of the mold at the spot shown in the sketch, there condensing and hanging as drops of water on the fillet of the core. This experience was a very important one and demonstrated two things very clearly to me, viz., the danger of having steam pipes through a foundry floor and how miserable a man can be made through no fault of his own.

A. C. MILLAR.

The Enterprise Foundry Co., Bristol, Tenn., manufacturers of stoves and hollowware, will reorganize under the name of the Enterprise Stove & Foundry Co., with a capital stock of $50,000.

Chas. H. Myers & Co. of Le Roy, Ill., will add a foundry to their plant.

Personal.

Thos. W. Little has been appointed foreman of the Brown Cotton Gin Co.'s foundry, New London, Conn.

James Barclay, who has been treasurer and superintendent of the Deere & Mansur Co. at Moline, Ill., for several years, is to be general manager and a member of the new firm of the Foster & Barclay Co., soon to be incorporated at Davenport, Iowa, with a capital stock of $350,000. The new company will manufacture a full line of farm implements. Property has been purchased at Bettendorf for the company's plant, and the work of construction of buildings will be begun as soon as weather conditions permit.

Chas. E. Price has been made assistant foreman at the works of the Bass Foundry & Machine Co., Lenoir City, Tenn.

H. C. Fellows has resigned his position as general manager of the Crescent Iron Works, Springfield, Mo., and is succeeded by M. B. Schaefter, formerly superintendent of the St. Charles Car & Foundry Co.

J. C. Manning has taken charge of the foundry of the Preble Machine Works at South Chicago, Ill.

G. L. Hoffer will have charge of the foundry now being erected by the Gulfport Foundry & Machine Works, Gulfport, Miss.

James S. Stirling has resigned as superintendent of the foundry department of the Harlan & Hollingsworth Co. to become vice-commissioner of the National Founders' Association.

Herbert M. Ramp has been appointed general foreman of the General Electric Co.'s foundry at Schenectady, N. Y.

Ben Gomersall has been placed in charge of the foundry department of the Battle Creek Iron Works Co., Battle Creek, Mich.

The Gruson Iron Works of Eddystone, Pa., are building a 200-ft extension to their foundry and installing additional equipment.

A foundry is to be built at Trenton, N. J., by the Iron Pipe & Supply Co., which will engage in the manufacture of cast iron pipe. The capital stock of the new concern is $100,000.

The Vulcan Iron Works of Wilkesbarre, Pa., have plans prepared for a foundry to be 115x300 feet in size and will require considerable new equipment.

Grading and Mixing Iron by Analysis.

The grading of foundry iron by analysis at blast furnaces has to a large extent taken the place of grading by fracture, and present indications are that it is only a question of time when analysis will entirely replace fracture grading; for this method of grading has proven more satisfactory alike to the furnaceman and founder, in many cases, when accurate and fully understood by the founder.

The analysis furnished with each car or lot of iron shows the per cent of various metalloids it contains, which exert an important influence on the iron when remelted and cast. By learning the percentage of various metalloids best suited for work to be cast the founder is able to produce castings with a greater degree of certainty as to quality of iron than by fracture grading.

The selection or mixing of irons by analysis for castings at the present time is largely upon the silicon basis; that is, this metalloid is considered the most important one in determining the characteristics of an iron, although other metalloids such as sulphur and phosphorus are taken into consideration.

The percentage of silicon iron contains is supposed to indicate the per cent of free and combined carbon and degree of hardness, softness, strength, chilling and annealing properties the iron may possess when cast into various sized castings. Before purchasing an iron the founder determines by analysis of castings having the desired quality of iron, the percentage of silicon they contain, and then selects or orders a pig iron conforming thereto, or one having a greater percentage that it may be melted with old iron or scrap and possess the amount desired in castings when cast.

Founders and furnacemen have learned that the percentage of silicon most suitable for various castings varies from ¼ to 3 per cent, and the founder has only to make known the amount of silicon desired or class of castings and per cent of scrap to be melted, to obtain pig iron from which castings may be produced with a greater degree of certainty, than by fracture grading.

This kind of foundry chemistry appears to answer very well for certain lines of castings and for small foundries that cannot afford to hire a chemist, but it cannot be called chemistry of foundry iron, for it is only rudimentary chemistry in which all the finer points are lost or overlooked and no large foundry, as those making large heavy castings under specifica-

tions requiring iron having a specified density, transverse and tensile strength, etc., would think of depending upon this kind of chemistry.

In selecting iron for such castings, any one of which may be worth a thousand dollars or more, all the metalloids and their effect upon iron are taken into consideration, and also effect of impurities in full upon the iron in melting and an iron produced at the spout having with a certainty all the characteristics required in specifications.

This can only be done by an experienced chemist, and grade analysis is of but little value. In mixing iron by grade analysis, the only rule or guide understood or practiced by a majority of founders is the known percentage of silicon the casting should contain, and the founder endeavors to obtain this amount in his casting. This he may readily do if his iron is properly melted, castings are heavy, remelt light, and pig alone is used, by purchasing pig having the required amount of silicon.

But these conditions are seldom found, for in all foundries it is necessary to make a mixture to work up remelt scrap if nothing else. In some shops it is necessary to melt old scrap received from customers in part pay for new work and in others scrap and a number of brands of pig are purchased to obtain a cheap mixture, so that in practically all cases mixtures are made, and in many cases desired results from mixtures are as difficult to obtain as by fracture grading. This is more especially the case when old scrap or a number of brands of pig are used. The remedy commonly applied in such cases is a pig high in silicon, but this does not always overcome the difficulty, and the founder is compelled to change his mixture and perhaps leave a pile in the yard for months, just the same as when mixing by fracture. This difficulty may be overcome by the founder to some extent by close study of analysis in mixtures, but few of them have the time or inclination to go so deep into the science and at the present time it is only the easy problems in mixing by analysis that are being solved by the founder.

EDWARD KIRK.

The Cause of Corrugation on the Surface of Chilled Castings.

Sometimes chilled castings of considerable surface area will have wrinkles or corrugations extending horizontally to the position of the casting as it was placed in the mold. This is a feature that occurs with some certain mixtures of iron more than with others. The cause of the phenomenon is problematical; yet it seems to me that it is rationally explained as follows:

Iron cast upon a chill sets more quickly than if cast in an all-sand mold. Iron that is high in combined carbon will set more rapidly than iron that is high in graphite carbon. The fact that some iron will chill while other iron will not, proves that some iron will chill more rapidly than other iron—because it is more or less rapid solidification that causes any iron to chill.

When the molten iron rises in the mold the topmost iron flows to the walls and against the chill and immediately solidifies. In non-chilling, soft iron, this instantly solidified film is extremely thin; but in true chilling iron it is comparatively thick. Suppose that such iron as this latter upon striking the chill instantly solidifies to the depth, say, of one-sixteenth of an inch; it is obvious that beyond this the iron will be in process of solidification to such an extent as to render it sluggish—something like wrought iron at a little above the welding heat. The result will be that the fluid iron, rising in the mold, will not exert sufficient force to press it out smoothly against the chill, and so a corrugation is formed. This will not be comprehended unless the reader has already perfectly grasped the fact that it is the topmost iron constantly flowing to the mold walls that forms the vertical sides of the casting.

If, then, one has trouble of this character with chilled castings, it is probably because the iron mixture has a tendency to chill too rapidly—it chills not only the iron in actual contact with the iron "chill," but extends the solidification out to a considerable distance over the upper surface of the rising mass of iron so rapidly as to render it non-fluent, sluggish, tough, stiff, not readily yielding to the pressure of the rising mass of molten iron and so, impossible of perfect confirmation to the surface of the iron chill.—E. H. Putnam in *The Tradesman.*

Some Brass Mixtures Made with Metallic Phosphoro.

The New Era Mfg. Co., of Kalamazoo, Mich., manufacturers of "Metallic Phosphoro," say that less than half the amount of this material is necessary to accomplish the same results as would be obtained by the use of phosphor tin. While Metallic Phosphoro does not belong to the class of fluxing agents which are used to prevent oxidation during the process

of melting it operates to increase the affinity between the different elements of a mixture, thereby securing a complete and perfect union of the same. It also increases the fluidity of the metal and thereby enables it to fill the mold with greater certainty, thus avoiding the loss from misrun castings. Besides it tends to prevent frothy and porous castings and leaves these of a fine and even grain throughout.

The amount of Metallic Phosphoro required for fluxing purposes varies from 2 to 4 ounces for each hundred pounds of brass, depending upon the condition of the metal being melted. If this is of a poor quality more will be required than if the metal is clean and of a good quality. The Metallic Phosphoro should be added to the mixture after this has been removed from the furnace and skimmed so that it is ready to pour. While some brass foundries are in the habit of melting their metal without employing a flux of any character it can not be denied that this practice occasionally results in the loss of fuel, labor, and other expense incident to remelting and reproducing castings which are imperfect, and it is a fact that remelting aggravates the first cause of all these losses.

It is claimed that where it is desirable to incorporate a large percentage of lead in brass or bronze castings that Metallic Phosphoro will materially assist in accomplishing this. In the manufacture of bronze the best results are secured by forming an alloy of the Metallic Phosphoro and other white metals before adding them to the molten copper.

The New Era Mfg. Co. is paying special attention to alloys which have to meet specifications in any form. The following formulas cover a number of bronze mixtures, which will be of general interest to the trade.

For a phosphor bronze, strong, malleable and of good wearing qualities use copper 68, tin 4.50, lead 24, zinc 2, Metallic Phosphoro 1.50. This alloy is of medium grain, takes a fine polish and in color closely resembles gold.

An improved aluminum bronze, which is non-oxidable, ductile, malleable and strong, takes a fine polish and in color strongly resembles gold, is made from copper 84, aluminum 1, tin 2, zinc 12, and Metallic Phosphoro 1.

A phosphor bronze, which in point of wearing qualities, degree of hardness and tensile strength has no superior is composed of copper 84, aluminum .05, tin 10, zinc 5 and Metallic Phosphoro .95.

A phosphor bronze steam metal of superior quality consists of copper 88, tin 10, lead 1.25, and Metallic Phosphoro .75.

The New Era universal bearing bronze, especially adapted for use as a bearing metal for soft steel journals, is made from copper 86, tin 7, lead 5.50, and Metallic Phosphoro 1.50.

A good phosphor bronze propeller metal of fine grain, very ductile, tough and strong, is produced by the following mixture: Copper 84, tin 3.50, lead 2, zinc 10, Metallic Phosphoro .50.

The New Era gun metal of superior quality is composed of copper 88, tin 8, zinc 3 and Metallic Phosphoro 1.

Process of Galvanizing.

In an article in the *Journal of the Franklin Institute* Prof. W. J. Richards says that the trade named "galvanizing" relates to the coating of iron with zinc. In order to do this the iron article to be coated must first be surface cleaned from all dirt and other impurities, so as to present a perfectly clean metallic surface. If any dirt, scale or oxide remains on the surface the zinc will not adhere to that part and imperfect work will be the result. This cleaning is done by immersing the article in a bath of sulphuric acid and water, washing well in water, plunging in hydrochloric acid for a short time and drying. The article is then put into the bath of molten zinc. If sheets or similar articles that will not retain much water are being coated the drying may be dispensed with to advantage. The galvanizing tank, or bath, as it is called, is of necessary size for the articles to be submerged, varying from ½ to 30 tons capacity.

This tank is usually oblong in shape and is divided on its surface by a longitudinal partition into two parts. On one side of the division a suitable flux is placed, which will dissolve the oxide of zinc on the surface or prevent its formation. The flux used is ammonium chloride, or, in trade parlance, sal-ammoniac. The other side of the bath is kept clean by continually skimming off the oxide of zinc as fast as it forms. In this skimming of the bath considerable shot metal is unavoidably removed with the oxide.

The side with the sal-ammoniac soon becomes covered with a thick black scum which consists of the dissolved oxide, which has partly decomposed the ammonium chloride and formed a double chloride of zinc and ammonium. The sal-ammoniac must be fed continually to the top of the bath so as to keep the surface of the molten zinc clean and free from ox-

ide, else the oxide will adhere to the iron surface and affect injuriously the finished product by leaving spots uncoated with zinc.

By the continued addition of sal-ammoniac the scum accumulates on the top of the bath and soon gets too thick for the workman to push his plates or other articles through, so a portion is removed from time to time. This yields on one side a waste called sal-ammoniac skimmings and on the other side zinc oxide or zinc skimmings.

Yet another by-product is made that is called zinc slab dross. This is formed by the continued washing away of a portion of the iron that is being galvanized, for zinc in a molten state will alloy with iron, so that as the iron becomes as hot as the bath its surface begins to dissolve in the zinc. If from accident or design a piece of iron is left in the bath after this dissolving process commences it will in time be entirely dissolved. Bolts, nails, castings, etc., are often found in the bottom of the bath which are all, as it were, eaten away or dissolved in the zinc.

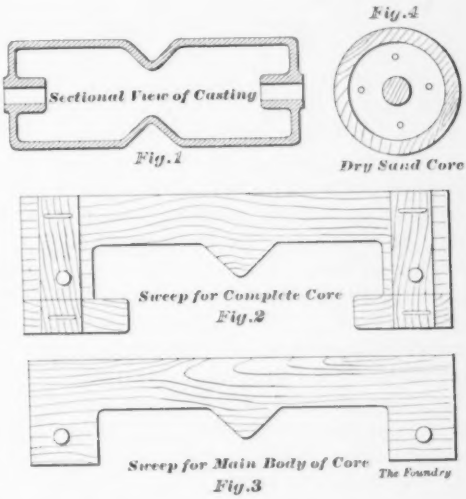
This addition of iron to the bath forms an alloy of iron and zinc that is of greater specific gravity than the zinc itself, and which falls to the bottom of the bath. If the bath is run hot it collects very fast, but under ordinary circumstances a bath of the usual size for pipes or sheets will make a ton of this dross in a week.

In order to have depth enough to do the work properly the dross must be removed. This is usually done every Saturday afternoon. A large spoon is used, perforated with holes to allow the zinc to drain out, and the semifluid dross is pasted into molds, smoothed off with a shovel, and is then the slab dross of commerce.

Making Cores for Elevator Rollers.

Some time ago we had a large number of dredge elevator rollers to make, the sectional form of which is shown in Fig. 1. We made the cores in loam, building these up on a two-inch barrel, having cast iron rings keyed on each end with projecting spikes to carry the overhang of the internal bosses at each end of the core. In making these cores we used the sweep, as shown in Fig. 2, the two projecting pieces being employed to form the bosses. These pieces were held in position by thumb screws and when each coat was finished they were removed endways from the core allowing the sweep to be removed without injury to the core. This method was found extremely tedious and unsatisfactory in many ways, besides considerable difficulty was experienced in securing the overhanging ends of the core, necessitating the patching up and nailing in many cases before the finishing coat could be properly applied.

After giving this method of making the core a trial it was finally abandoned and a plain sweep used as shown in Fig. 3, to form the main body of the core. This was swept up in the same manner as formerly on the same size barrel with the exception that the core, when finished by the sweep, was six inches shorter



than required and had plain ends. To obtain the proper length, and form the bosses at each end, a core, as shown in Fig. 4, was employed. This is simply a plain ring core which, when nailed to each end of the loam core, makes this complete and avoids the difficulties experienced when this is swept up entirely. This latter method also proved much speedier and cheaper than the former and the castings were as good when the core was made by one method as the other.

HARRY WILLIS.

The Chicago Heights Malleable Iron Co., of Chicago Heights, Ill., has been incorporated with a capital of $50,000 by W. E. Canedy, John H. Hood and A. W. McEldowney.

The American Pin Co., Waterbury, Conn., has let the contract for a foundry 62x162 feet.

The Frank Way Foundry & Machine Co. of Chillicothe, Mo., is incorporated with a capital stock of $50,000.

Willful Waste in the Foundry.

Under this heading an English foundry foreman takes up some of the leakages in the average jobbing foundry and while we believe his picture of waste is largely overdrawn in many particulars, yet there are many shops which do not take as good care of tools and shop appliances as they should. It is all a matter of habit as to the disposition a molder makes of a surplus of nails, chaplets, etc., and if he is allowed to throw these things away in twenty-five pound lots, we do not know but that the foreman of the shop is as much to blame as anyone else. Then again it might be suggested that if such is taking place from day to day that the molder would be making his sand heap an uncomfortable scrap pile to work with. We have worked with a good many British molders and have never known them to be in the habit of getting six times the quantity necessary of any article they needed, but then it may be that they behave themselves better when they are away from home.

In regard to the molder's tendency to kick over a blacking box in order that he may utilize it in holding sand he needs in patching molds, it is our opinion that shops where this takes place do not have enough of the little conveniences which should be found in well regulated establishments. We agree with the writer that too much dead stuff is allowed to accumulate around foundries in the form of old lifting plates, flasks and scrap in various forms. The story of the molder who uses too much facing sand is old and "hundreds of yards of gate sticks" sounds enlarged. This foreman does not seem to be proud of the balance of those holding this position but then there is so much greater a chance for him to show how far he is ahead of the others. Writing in the *Mechanical World*, he says:

Foundry masters have asked, and are asking every day in the week, the reason why they cannot compete successfully, not with America, Germany, or other firms across the sea, but with their next street rivals, who are all practically working under the same conditions. This has been a burning question for a long time, and it is only now and then we see a feeble attempt made to remedy the defect. It is not because they have not got good men; it is not because they lack knowledge of the trade, but because they do not possess the push and energy required of a progressive, go-ahead successful foundry master. They are, as a rule, content to accept whatever they get, be it right or wrong. Suppose inquiries are out for the molding of 400 tons of castings, and each ironfounder in a large district is invited to quote. Assuming there are forty estimates received by the party calling for them, it will be safe to say there will be a difference of from £200 to £300 in the prices quoted. The writer has seen a quotation in which one firm quoted £600 more than another for the same job, the successful quotation being £500, which paid, and paid well. Now this is just a sample of what takes place in our midst every day. The unsuccessful quoters say to themselves, "How is it?" But do they say, "I will find out"? No. They just jog along in the old, sweet way; and if this is the case on our own doorstep, how can they think of touching the wide-awake people across the seas who are daily crippling our trade.

Ironfounding stands in a good position for making money quickly, and there is no other trade in which it may be lost more quickly. But the object of this article is only to show how money is "willfully" lost and thrown away in the foundry.

Let us take a walk inside the foundry and have a look round. It is midday, and the molders are in full swing at their different jobs. We stand beside a mold that is just about finished, and on the top or joint of it there are perhaps a ¼-cwt. of nails, screws, chaplets, studs, and other useful and expensive articles lying about. The three or four molders are now sweeping off the joint preparatory to closing the mold, and as each man cleans a certain space he picks up so many of the nails, etc., lying about. But are they collected and returned to their places? No; they are thrown down in the sand or anywhere just clear of the job, and as a result are covered up, rusted, and of no further use. This is only one job we have seen; but if it is done on one job, it is safe to conclude that it is the practice throughout the whole shop. The same articles are wanted tomorrow, and the men go to the stores and bring a fresh supply, the overplus meeting the same fate as previously. We assert that it is a common custom for a molder to obtain six times the quantity necessary of any article he may require. But it doesn't signify, as there are plenty in the storeroom. Here is a molder coming towards us; he is looking for a wooden box to put some facing sand in to finish his mold with. There is one just by us which was used to hold the expensive plumbago for a previous job; it is half or three-

parts full of plumbago, but he picks it up and —empties it back into the blacking tub?

Not he; that is too much trouble, and he doesn't have to buy it, so he empties it on the scrap heap, and kicks some dry sand over it to hide it. This is the general fate of all material that has been left unused, and if you have from 50 to 200 men wasting material in this fashion, it can easily be seen where the profits go.

Wrought iron wedges are extensively used in a foundry, and scores are made and lost every week. After use they are thrown about the shop and buried, causing new ones to be constantly made, to eventually meet the same fate. Hundreds of wrought iron spikes from 3 to 6 inches long, of ¼ to ⅞-inch iron, are made and lost. The loss of the iron is not a great consideration, but the smith's time must also be taken into account.

The way in which loam and facing sand is used to excess in the foundry is also a matter calling for attention. Now, 1 inch of facing sand round a pattern is just as good as 12 inches. But go into any jobbing foundry, and you will see men using a barrowful where a good spadeful would have been sufficient. The same remarks apply to loam, which should only be used for lining the pattern, or the face of the pattern. All outside building should be done with black sand, which should be put through a ¼-inch riddle and moistened with water until it becomes a thin slurry. By this plan half the drying is dispensed with and a great saving in fuel effected. Hundreds of yards of timber are used to make "gate sticks," and they are rarely used more than once, being thrown away or burned. When wanted again, another lot is made by the patternmakers, and so on. Drying stoves are kept constantly going when there is no need, except to waste fuel. They should be kept heated during the day with a very small fire, so that it will not take too long for them to regain their usual heat when filled with cores, etc., and fired at night. Many foremen think they are doing a good thing by saving and heaping up in the yard lifting irons, core plates, grids, etc. But this practice should be done away with, and when a core iron or lifting plate has been made, and is not wanted again immediately, it should be broken up and turned into money instead of consigning it to the yard to eat its head off for years. A man gets a job for which he requires a lifting iron. He goes out into the yard, and after turning over the heap, spending a considerable time, he finds nothing that suits him. Someone says there ought to be what he wants in the yard, so he goes and wastes more time uselessly. If there had been no accumulation in the yard, that job would have been considerably advanced, instead of time being lost.

Observe a loam job having the bricks stripped off it, and you will see the laborers hacking into the center of good whole bricks with a sharp chisel bar, cutting them in two, instead of getting between the joints and keeping the bricks whole. Then the loam that comes from the face of the casting will be wheeled out to the rubbish heap instead of to the mill, to be ground up and used again. Look on the heap where the cupola man throws his refuse, and you will without doubt find a quantity of good coke that should have been separated from the clinker which surrounds it, and used again. Watch the cupola man mending his cupola, and you will see him plaster on a large barrowful of expensive gannister, instead of patching up the bad places with firebrick.

These remarks could be considerably extended, but enough has been said to open the eyes of foundry masters to the losses they are daily incurring. It may be asked, What has all this to do with competition? To this question the answer is simple: a foundry owner running his foundry is equivalent to running his private home; the more he has wasted and thrown away, the more he will require to keep it going. Masters will say, well, we pay foremen to look after our interests. But does every foreman do it? And does every master satisfy himself that it is done? No; the latter does not trouble himself, for if he did he would find in five cases out of ten that his foreman had no more forethought of the economical working of a foundry than the smallest boy in his shop. And this will continue to be the case so long as masters are content to accept the minimum of production and the maximum of willful waste.

Reminds Him of Old Times.

Your description of the Blake Roll-Over molding machine in the October issue of THE FOUNDRY recalls to me early days, when I went to learn the trade at the age of thirteen, and after eighteen months' errand running and helping the drysand molder, I was sent to help a lad six months older than myself on a machine, one in all re-

spects similar to the Blake, save that the lever for raising the under table was replaced by a large hand wheel and the balance weight was in the pit. On this we were supposed to ram up twenty-two boxes a day of table bowls, tape bowls or any small article used on printing machines. The molders took turns in pouring off the molds for us, and each apprentice had about twelve months of this kind of work by way of getting a practical knowledge of machine molding, and incidentally making a first-class profit for the firm, as our combined wages were at that time but twelve shillings weekly. H. SAYERS.

Hunslet, England.

Notes from Various Sources.

The Chrome Steel Works, of Brooklyn, N. Y., have incorporated with a capital stock of $500,000. The company are building a large plant at Carteret, N. J., where they will move their Brooklyn plant as soon as the new works are completed.

The Buffalo Forge Co., of Buffalo, N. Y., are mailing to the trade a folder describing the Buffalo fan system of heating and ventilating.

The Meyer Furnace Co., Peoria, Ill., have just completed a new factory building covering an area of 73x175 feet in size, most of the structure being two stories in height. The company also contemplates doubling the capacity of their foundry, so that when completed it will cover an area of 60x100 feet in size.

J. Gilmour, Bennett Bldg., New York City, has issued catalogues of cranes and general foundry equipment which may be had upon application.

The Zanesville Malleable Iron Co., of Zanesville, O., has passed into new hands, R. H. Frees, of Walkerville, Ontario, and associates having sold the controlling interest in the company to H. A. Sharpe, John Brown, J. W. Wells and J. D. Brennan. Mr. Wells has been elected president and Mr. Brennan general manager. The company are planning to enlarge the plant, which was erected a short time ago. R. H. Frees and associates still retain an interest in the plant.

The Christensen Engineering Co., of Milwaukee, has established an office in the Merchants' Loan & Trust Bldg., Chicago, which will be in charge of Chas. G. Burton.

It is reported that the Babcock & Wilcox Co., of Bayonne, N. J., intend to add a foundry department to their plant.

Sim Allen has been appointed foreman of the Duisdieker Foundry & Mfg. Co.'s foundry at Pekin, Ill.

Under the title of "Points for Steel and Iron Makers," Geo. G. Blackwell, Sons & Co., Ltd., of Liverpool, Eng., have issued a booklet dealing with their S. A. M. alloy, in which they say that in order to prevent blowholes and produce sound ingots and castings it is necessary to add to the steel or iron an alloy consisting of metals such as aluminum or manganese, having a greater affinity for oxygen than the metals to be cast, and one or more electro-negative non-metallic elements, such as silicon or boron. The constituents of this alloy are converted by taking up the oxygen from the casting into single, double or multiple silicates, borates, etc., which produce a readily fusible slag. This slag forms quickly and rises in the form of globules through the liquid metal, rendering the latter free from blow holes.

Robert Poole, president of the Robert Poole & Son Co., Baltimore, Md., died Jan. 15, aged 75.

Brittleness of Certain Alloys.

Replying to a question as to the cause of a zinc, tin, copper and aluminum alloy deteriorating in quality and becoming brittle a correspondent to the *Aluminum World*, says: There appears to be no explanation of this phenomenon. Some alloys have the property of disintegrating within a short time, others consume a much longer period in doing so, while the majority do not have the property at all. The phenomenon is one of the freaks of nature and cannot be explained any more than the fact that one metal possesses a higher melting point while another melts at a low temperature. Alloys of aluminum and tin appear to have this property in a remarkable degree; in fact we have seen an alloy of equal parts of tin and aluminum which had been rolled into sheet, become as brittle as glass within a few days. An alloy of equal parts of nickel and aluminum will also disintegrate but not as quickly as the aluminum and tin alloys. If this property of disintegration is not desired, it is necessary to eliminate the tin entirely. Roughly speaking, therefore, it may be said that tin is the usual cause of such a phenomenon in aluminum alloys.